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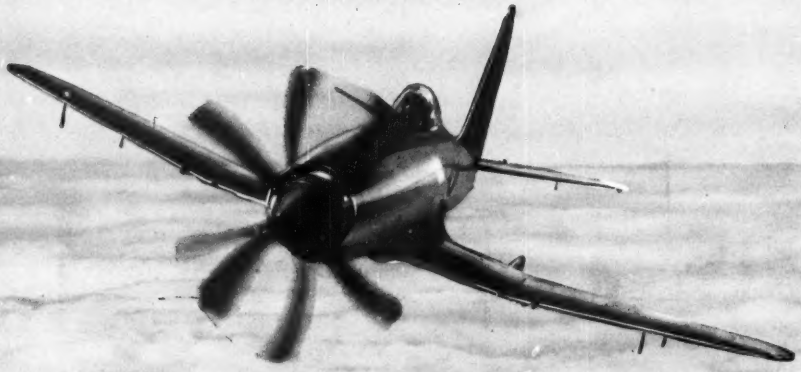

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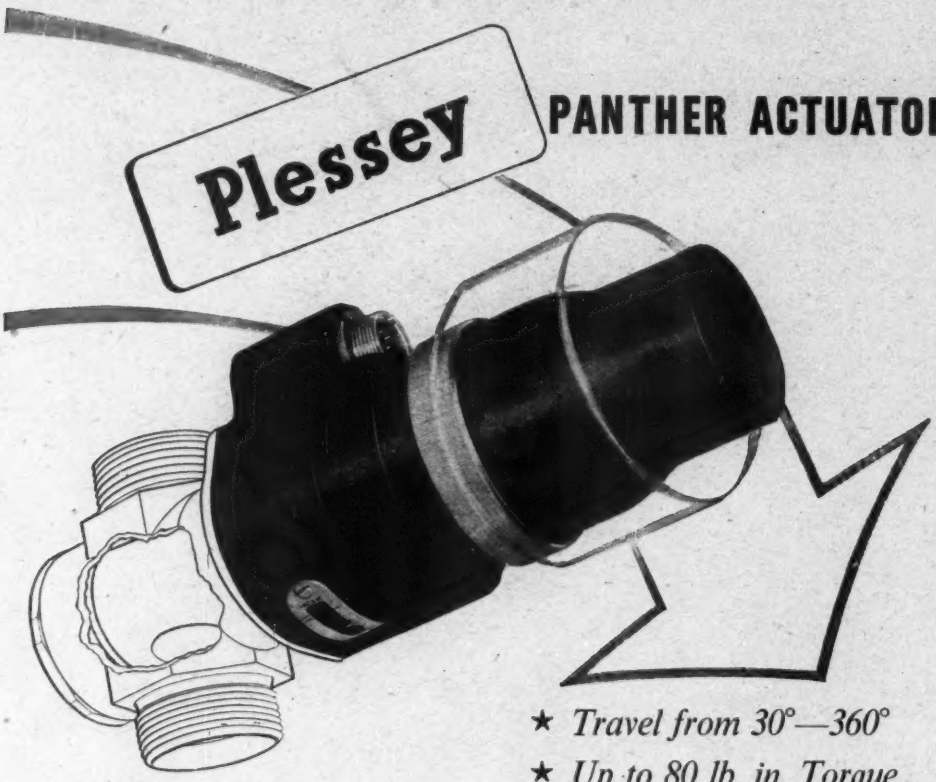

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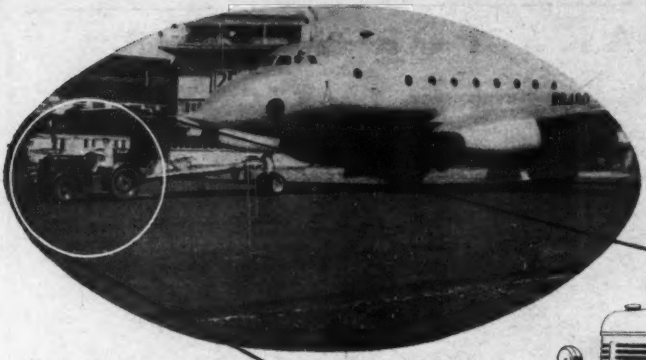

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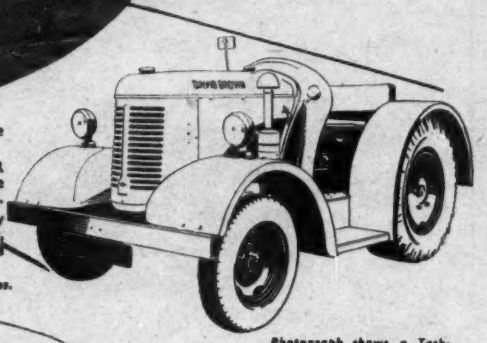

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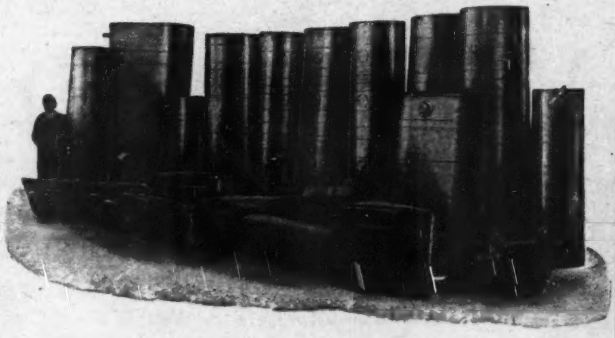

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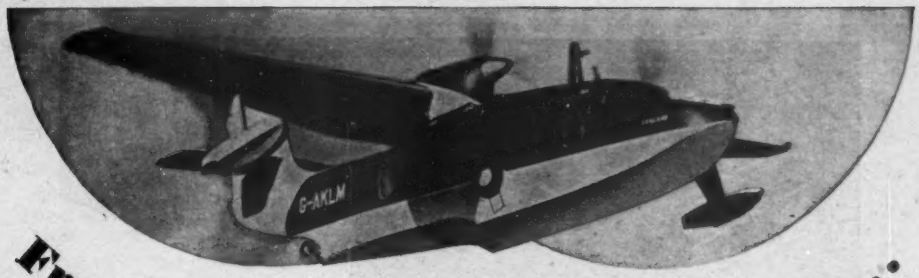
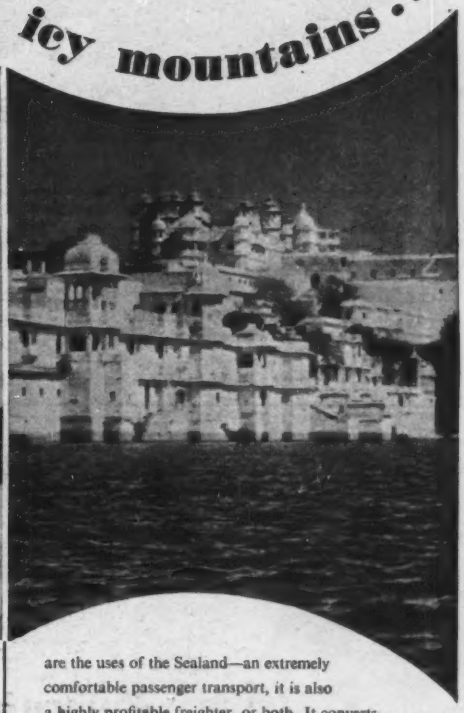


From Greenland's icy mountains . . .



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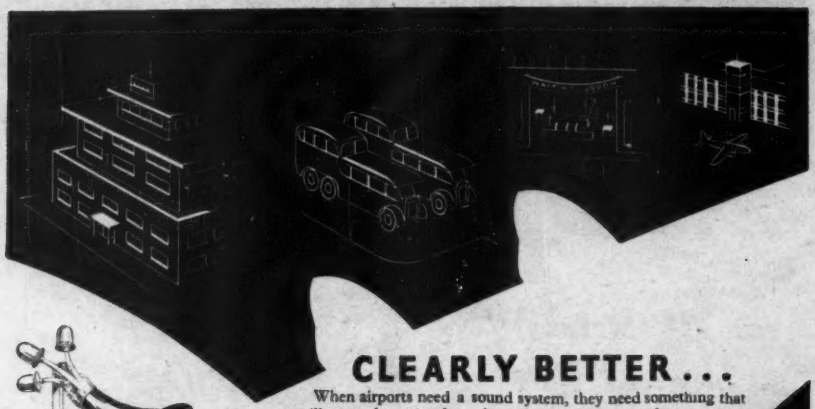

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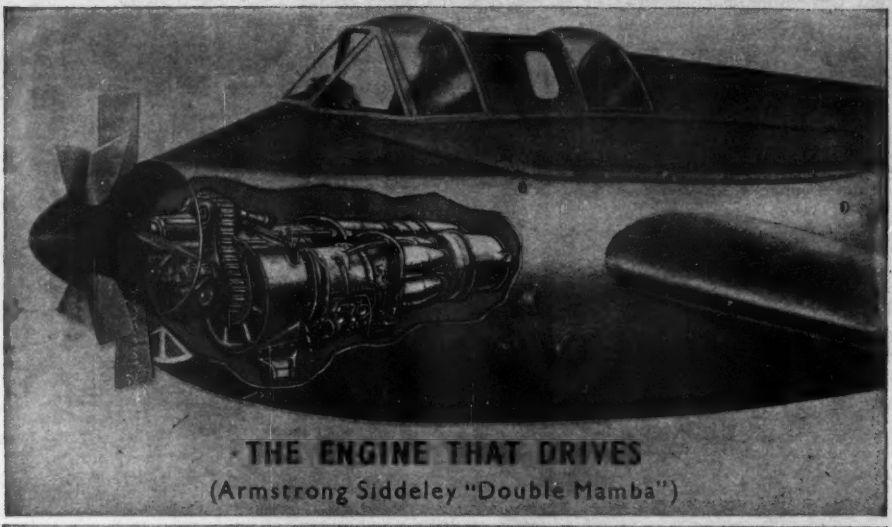

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Virtue Unrewarded

TEST pilots are not given to worrying over-much about their jobs, nor, in spite of the glamour which inevitably surrounds much of their work, are they imbued with the Hollywood outlook. On occasions, theirs is the world's biggest stage, with all the heavens their backdrop. No ballerina shows finer poise and no juggler or acrobat has need of closer timing or better judgment. Yet Danny Kaye reputedly earns as much in a six-week London "season" as many British test pilots receive in six years.

Should one induce a test pilot to talk of these matters he will probably remark, "Always do with a bit more, old boy"; and if pressed he may tell you that what worries him much more than the present is the matter of providing for his wife and children after he has been retired from a few short years of active test-flying.

Of the two main branches of test flying—for the industry and for the Services—what do we usually hear the aircraft manufacturers say? That the pilots are paid highly for their age; that their insurance is heavy; and that the cost of sending one on the Empire Test Pilots' course is terrific, quite apart from the fact that he must be paid while on it, and a substitute employed in his place for the ten months.

Yet these men, "expensive" or not, are no luxury which can be given up in hard times; they are a vital part of the aircraft industry. It is they who are responsible for making ordinary designs into outstanding aircraft or, on occasions, turning theoretical data into accomplished fact, or again, investigating mysterious faults or phenomena for the greater safety of their fellow aviators.

Turning to the second group of test pilots—those employed in that capacity while living as serving officers—we see them as capable, experienced, but otherwise ordinary Service pilots. Over and above this, however, they share with their civilian brothers the gift of an enquiring mind allied to that bright spark of enthusiasm and dash which is the mark of the born test pilot. Yet does the Service appreciate the spirit and the courage (beyond the normal call of duty) so often displayed by these officers? The answer is almost certainly in the negative. No credit is given officially for a period spent as test pilot, promotion may even suffer, a balanced Service career is considered to have been upset. There are cases of pilots completing a period of test flying, at Boscombe Down for example (and therefore among the most "clued" on such subjects as handling and the capabilities of new aircraft and armament) and then being posted for personnel duties, or equally inappropriate jobs, at some such place as Shaibah. Apart from being soul-destroying for the man concerned, this sort of thing is a very real waste.

What, then, can be done about these matters? The aircraft industry has not been ungenerous to several of its veteran test pilots, and some have even gone on to receive well-deserved directorships; but it is for the majority of others, with more limited experience and qualifications, that congenial employment may be hard to find.

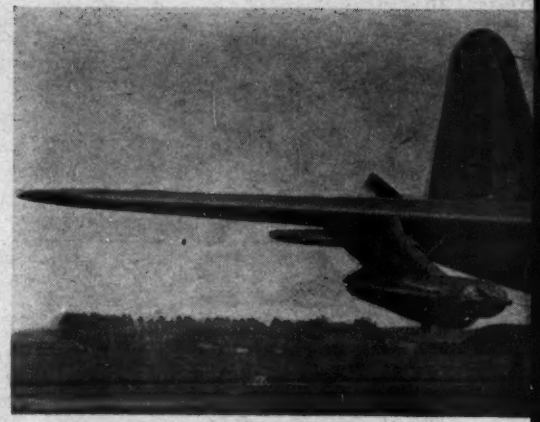
It seems likely that nearly all test flying—of prototypes in particular—will in the future be undertaken by Service pilots who have in the first place volunteered for the job. Maiden flights of all-important military, research and even some civil prototypes may be made by staff pilots of the Ministry of Supply, as, in fact, some already are. Pilots may be seconded to manufacturers from the R.A.F., and after a tour of duty revert to a normal Service career.

Such arrangements must, however, depend upon the proper recognition of the status of test pilots within the Service, otherwise very few men with the requisite qualifications will offer themselves. As a start, a symbol should be authorized at once, admissible in retrospect, for all who have passed the course of that unique establishment, the Empire Test Pilots School. In addition, an assurance should be given that a three-year tour as test pilot (four, with the training period) would be properly integrated into the pilot's planned Service career. As a rider, we may suggest that a retiring test pilot should next be employed where his knowledge is likely to be most valuable—by a unit such as C.F.E. or C.B.E., at the Flying or Staff Colleges, C.F.S., or even in the department of the Director of Operational Requirements.

VISITING GIANTS

Convair B-36 Heavy Bombers and Douglas C-124 Transports at Lakenheath

Illustrated with *Flight* Photographs



NO military aircraft has been more vehemently condemned than the Convair B-36 heavy bomber; and none (short of war-time achievement) has vindicated itself more fully. Much early criticism was founded upon the flimsiest kind of gossip; claims were attributed to the makers and to the U.S.A.F. which had never, in fact, been advanced, while demonstrated performances were openly ridiculed.

This journal lays no claim to exclusive information on an aircraft which is still semi-secret, nor does it intend, on this occasion at least, to propound arguments which might inflame the dissension still persisting in respect of the B-36. But having viewed examples of the type in this country and discussed its characteristics with authorities better informed, we suspect, than the general run of B-36 detractors (and certainly less prejudiced) we are constrained to put three facts on record.

First, the design and quantity production of the B-36 is a technical achievement of the first order, especially so as the aircraft fairly bristles with the most complex services and installations. It must be borne in mind in this connection that the B-36 is approximately as large as, and far heavier than, the Brabazon I airliner, which has created so many vexed issues in British air circles. Second, the U.S.A.F. has introduced the type into service with a singular absence of fuss and bother, notwithstanding the multitude of teething troubles which were only to be expected with so vast a machine. Third, whatever the operational capabilities of the B-36, and whatever types of bomber *might* have now been serving in its stead, the free nations of the world may count themselves fortunate that the momentous decision to proceed with the B-36 project was taken in due time.

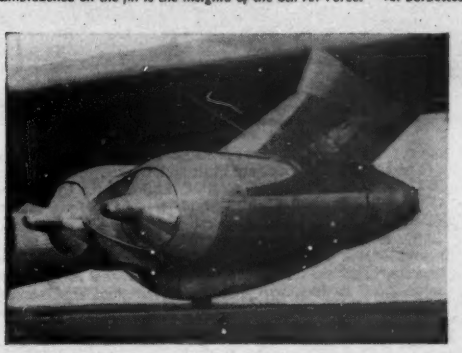
Certainly it was a reassuring and memorable experience, on the morning of January 17th, to see six of these giants at Lakenheath, in company with their supporting transport element of three Douglas C-124 transports—the newest and largest aircraft of their class in the world.

The B-36s—of the latest "D" sub-type—were on a routine long-range navigation training flight, similar to those already made to Caribbean and Pacific areas. Based at Carswell, near Forth Worth, Texas, they are units of the 7th Bombardment Wing, 8th Air Force, Strategic Air Command. Having been airborne for over twenty-four hours, and covered more than 5,000 miles they arrived at Lakenheath on January 16th. Though details of times and routes have not been disclosed, it can be said that much of the flight was made in darkness. The three C-124s, with maintenance personnel and spares, arrived in advance.

Security measures at Lakenheath were formidable—even, on occasions, exasperating—but amply justified. The particular B-36 on view to privileged visitors was roped off, though, as will be seen, detailed photographs were permitted. Only Service personnel were allowed aboard. More rewarding than inspection of the aircraft itself, however, was the briefing by Lt. Col. John Bartlett, Operations Officer, 7th Bomb Wing, and conversations with crew-members of the selected machine. This bore the service number 92658, and (we copied it for the benefit of those who rejoice in such details) the serial number B-36D-25-CF49-2658A. The functions and names of the crew are given not only as a guide to the manning of a B-36 on a long-range mission, but in appreciation of courtesy and tact of the personnel concerned. Aircraft commander, 1st Lt. C. F. Horton; pilot, 1st Lt. J. J.

Better than any verbal description, this photograph of a Douglas C-124 in company with a Boeing C-97 (military Stratofreighter), conveys the immensity of the Douglas. Both machines are powered with four Pratt and Whitney Wasp Major 28-cylinder engines of about 3,500 h.p. each.

A Gloster Meteor 4 acts as a yardstick for one of the visiting B-36s. Respective lengths of the two machines are 43ft 6in and 162ft. The B-36 depicted has yellow nacelle-noses and nosewheel doors, yellow-tipped vertical tail surfaces, brown and green radar blister, and black identity markings. Emblazoned on the fin is the insignia of the 8th Air Force. All barbettes are retracted and quite invisible. Armament is sixteen 20 mm guns.



Shutters at the intakes of the B-36's paired, underslung General Electric J-47 turbojets exclude foreign bodies on the ground and reduce drag when the units are inoperative during flight. The jet "pods" are now braced by struts inboard of the main supporting member.

McDaniel; radar, Capt. P. G. Hutchinson; navigators, 1st Lt. A. M. Rockwell, 1st Lt. V. E. Corroppoli; flight engineers, M/Sgt. E. O. Benefield, 1st Lt. C. D. Orrison; radio operators, S/Sgt. R. M. Robinson, S/Sgt. V. W. Yerian; chief gunner, T/Sgt. R. E. Greenfield; gunners, S/Sgts. C. A. Kratochvil, W. C. Moore, W. F. McCleland, H. G. Layman; radio technician, T/Sgt. C. U. Womack. It was explained that one pilot was sick at home. Four members of the crew are "reliefs."

Colonel Bartlett reminded us that at one time the U.S.A.F. recognized a few "lead" crews, the remainder being "average." To-day, he said, the stage has been reached where every heavy-bomber crew is a lead crew.

The 7th Bomb Wing and other units of the 8th Air Force, commanded by Lt. Gen. Curtis Le May from his headquarters at Omaha, Nebraska, may become solely a B-36 force. Though the majority of the B-36s on charge are bombers, some, designated RB-36E, are equipped for reconnaissance. One such machine has lately remained in the the air for 51 hr 20 min without refuelling. The Strategic Support Squadron, which supplied the attendant C-124s, seen at Lakenheath, is also part of Strategic Air Command.

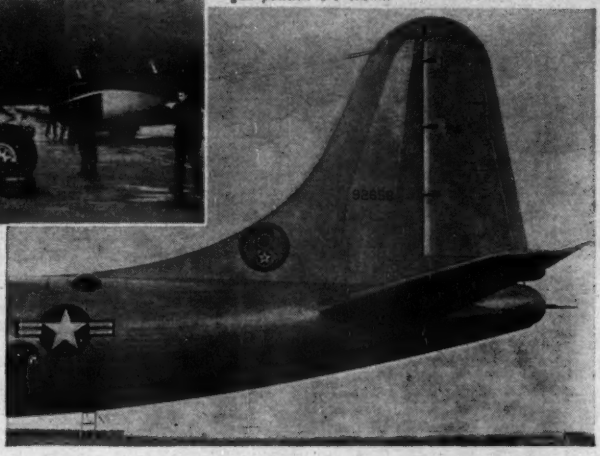
Most B-36 crews are seasoned B-17, B-24 and B-29 operators, and their qualities and experience were invaluable during the "shaking-down" phase of the B-36 project. Normally, special test crews from Wright Field (the U.S.A. counterpart of Boscombe Down) are responsible for initial service-testing, but with the B-36 the experiment was made of delivering the aircraft direct to the "user agency," that is, the operational unit concerned. Thus, the Colonel recalled with frankness, the B-36 was unproven when it entered service, and many troubles arose—engine fires and propeller-shedding among them. At one time any crew returning from a flight without some disaster to report was considered "cissy." Initially, only crews with 1,000 hours of four-engine experience were accepted for B-36 squadrons, but to-day a log-book showing 500 hours of four-engine time gives admittance to the fraternity of giants.

Among the most important crew-men are, of course, the flight engineers, for the B-36 is ten-engined (six Pratt and Whitney Wasp Major piston engines and four General Electric J-47 turbojets). The pilot relieves the engineers of some responsibilities respecting the jets, and their task is further eased, in some measure, by the gunners, who, from their sighting blisters, are continuously scanning the wings and engines for oil and petrol leaks, loose cowlings, icing, etc. Their "check list," in fact, is a formidable one.

Lieutenant Horton (aircraft commander) said that the trip to England was made at various heights up to 35,000ft. Considerable icing was experienced but the B-36s made light of this. The anti-icing and de-frosting system uses engine-air, passed through exhaust-gas heat-exchangers, and then ducted between the double skin of the wing and tail-surface leading edges, between the double glass of the bomb-aimer's and pilot's enclosures and to the gun-sighting blisters. One of the engineers assured us that enough heat is generated to warm a four-storey building—though not, perhaps (he added, feelingly) in this country!

One was able to learn something of the technique of using the B-36D's auxiliary jet units. They are normally in action at take-off, though on a 10,000-ft runway, such as that at Lakenheath, their added thrust is by no means indispensable, even at the maximum flying weight of 358,000 lb. The reduction in take-off distance they afford, however, enables the B-36 to use many dozens of airfields in various parts of the world which were formerly denied it.

It is usual to continue the jet-assisted climb to 10,000ft and then to cut out the jets, continuing up to cruising height on Wasp Major power alone. To attain bombing height the jets are brought in again and remain operative as the target area is approached. For example, if a B-36 were raiding London, the jets might be started over Prestwick. Over-target speed is steadfastly claimed—not by the U.S.A.F. public relations officers alone, but by Colonel



In the left-hand view, showing the complete nose section of a B-36, visible features of interest are the forward guns; bomb-aimer's panel; cockpit enclosure and astrodome, with emergency exit below and somewhat to the rear; gun-sighting blister; radar fairing; and twin, steerable nosewheels. The black parallel lines to the rear of the sighting blister indicate the limits of the sliding door covering the upper barbette. In the lower picture the rear sighting-blisters, tail surfaces and tail gun position are shown.

VISITING GIANTS . . .

Bartlett himself—as "in excess of 435 m.p.h." Service ceiling is "over 45,000ft." The jets remain in action until the target area is cleared. They are, moreover, a valuable corrective for asymmetric power conditions arising from engine damage or failure, and with their aid a B-36 having two inoperative piston engines can take off (the redundant propellers having already been shipped aboard an attendant C-124) and return to base.

Jet power was used during the trip to England whenever bombing attacks were simulated at unnamed points *en route*. When Lieutenant Horton's aircraft had descended to about 30,000ft over the English coast, it began to receive the attentions of a strong reception committee of Vampires and Meteors, whose manœuvres seem to have made a deep impression on the bomber's crew. The sixteen loaded cannon were not, however, brought to bear for fear of accident.

All the B-36s carried full ammunition and a simulated bomb load. On every long-range flight, in fact, they operate at maximum weight, for General Le May is insistent that the American people shall get the utmost value out of the 2,100-2,200 dollars which is the hourly operating cost of a B-36. By the same token, the General insists that simulated attacks should be made on a number of targets on every long-range flight; during 15-20 hours in the air a B-36 might go through the motions of attack on five, six, or even eight occasions, using radar, photography, or other means to represent the bombing.

A brief description of the B-36D, based on our own observations and on the latest information supplied by the makers, seems timely. The design was supervised by I. M. Laddon, who was also responsible for the Liberator, Catalina and other famed Convair types. The wing measures 230ft in span, has an area of 4,772 sq ft, and is of an N.A.C.A. laminar-flow section; it is mounted slightly forward of the fuselage mid-point. The total area of the electrically-operated flaps, which are in three sections on each side of the fuselage, is 519 sq ft—greater than the total mainplane area of the four-engined Handley Page Marathon. All control surfaces are manually operated through the medium of spring-tabs.

Over the greater part of its 162ft length the fuselage is of circular section. The total area of the fuselage skin is 5,635 sq ft, and the volume, 17,724 cu ft. The pressurized forward and aft cabin spaces total 3,924 cu ft. Extending the entire length of the bomb-bay section, on the port side of the fuselage, is a pressurized, magnesium communications tunnel, 85ft long and 2ft in diameter, through which transport is afforded by a four-wheeled trolley. The armament of sixteen 20 mm cannon is disposed in six remotely-controlled retractable barbettes, and in nose and tail positions. The designed bomb-load, for a 10,000-mile range, was 10,000 lb, but for an unspecified distance a load of 84,000 lb is possible.

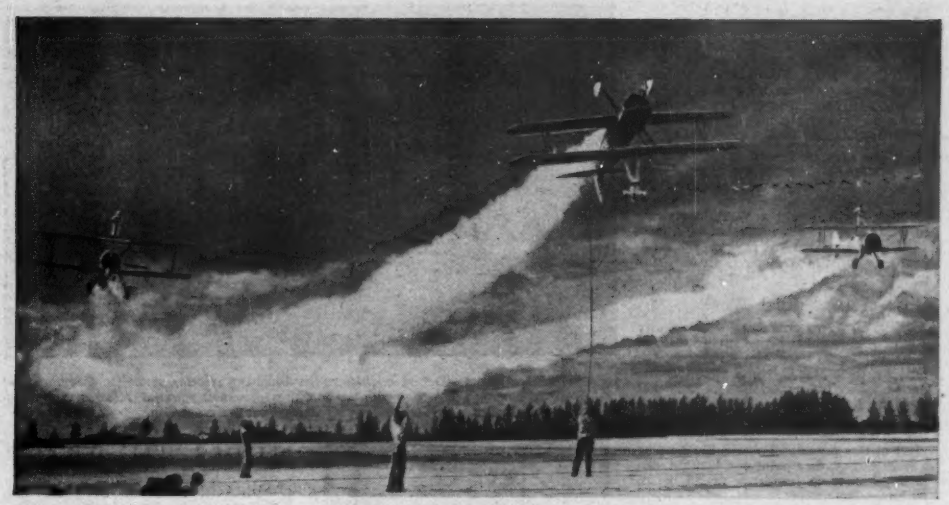
The six piston engines are Pratt and Whitney Wasp Major R-4360-41s, developing a total of 21,000 h.p.; they drive 19ft reversible-pitch Curtiss propellers. The four under-slung jets are axial-flow General Electric J-47s, which add 20,000 lb of thrust (equivalent to about 19,000 h.p.) to the power of the piston engines. The complete main bogie undercarriage units weigh together over 17,000 lb—a figure some 2,600 lb less than that for the original single-wheel main units. The nosewheel is of steerable twin-wheel type.

Reluctantly leaving the B-36, we were conducted into the awesome presence of the three C-124 transports, the sheer bulk of which can be appreciated better from examination of the photograph on p. 90 than from the most apt description. The C-124 is the largest military transport in production; it spans 173ft 3in, is 127ft 2in long and 48ft 3in high. The wing, power plants and tail are those of the C-74 Globemaster I, seen in Europe during the Berlin Air Lift operations, but the fuselage is totally new and of much greater capacity. Clam-shell nose doors afford an opening 11ft 8in high and 11ft 4in wide. There is a folding ramp of appropriate dimensions. With the removable intermediate deck in place 200 fully-equipped troops can be accommodated in the unobstructed fuselage space—77ft long, 13ft wide and 12ft 10in high. Centrally disposed is an electric lift for loading cargo. Certainly, these huge and well-liked machines are worthy allies of the B-36s.

A MIG-15 ASSESSMENT

SPEAKING in Tokyo last week, after a tour of American Far Eastern Air Force units in Korea, General Vandenberg, U.S.A.F. Chief of Staff, expressed great confidence in the efficacy of the F-86 Sabre fighter. The Russian Mig-15, he said, was not so good an intercepter as its American counterparts; and it was not much used as a fighter-bomber because its armament was inadequate.

General Vandenberg felt that the Far Eastern Air Force could handle the air situation in Korea, and he greatly admired the "very professional job" its units were performing. He was particularly impressed by the successful night operations and armed reconnaissance which were making it difficult for the enemy to move supplies to the South. Strategic bombing of the enemy's bases would be most effective, but as this was prohibited armed reconnaissance was the only solution.



FORMATION FANTASTIQUE : Circus turn by the Cole brothers, flying acrobats, at the recent All-American Air Manœuvres at Miami, Florida. They stand astride the top mainplanes of three smoke-streaming Boeing trainers, one of which is upside-down ; despite danger and discomfort, the inverted acrobat provides the pièce de résistance by breaking a ribbon stretched a few feet above the ground.

HERE and THERE

B-36 Over London

LONDON had its first look at a B-36D when one of these big bombers flew over the capital at about 1,500ft on the morning of January 18th. As reported on p. 90, six B-36s visited Lakenheath for a few days last week; they returned non-stop to Fort Worth last Monday in 30 hr 16 min.

More Fighters for France

ACCORDING to the French Air Minister, M. Maroselli, six squadrons of Thunderjet fighter-bombers will be in service with the French Air Force by next December. The number of Vampire squadrons, he said, would be increased to 11 (at present there are nine, each with 16 Vampires) by the end of the year and six more would be formed in 1952.

Production of the Nene-powered Dassault 450 Ouragan fighter is now under way, and 162 are on order, together with six "improved" Ouragans—presumably swept-wing Mystères.

U.S.A.F. Turboprop Transport

CONSTRUCTION has begun of the first turboprop-powered transport for the U.S.A.F.—the Douglas YC-124B, a development of the C-124A Globemaster II. Power-units for the YC-124B, which is scheduled to make its first flight in the spring of 1952, will be four 5,500 h.p. Pratt and Whitney YT34-P-1 turboprops driving 18ft, three-bladed Curtiss airscrews.

With these units, delivering almost twice the total power of the Wasp Majors used at present, the new Globemaster's all-up weight will be increased from 175,000 lb to 200,000 lb; payload and performance will be considerably improved. As a trooper, it will be able to carry 200 armed men.

More Stratojets

AT its Tulsa (Oklahoma) factory, the Douglas Aircraft Company is to build Boeing B-47 Stratojet bombers, supplementing Boeing's own production at Wichita, Kansas. A comparable arrangement for expanding jet-bomber production was recently made in Britain when plans were announced for making English Electric Canberras at the factories of Handley Page, Avro and Short Brothers and Harland.

R.N. Helicopter Trials

WESTLAND - SIKORSKY S-51 Dragonfly helicopters are being operated from a small platform on the 11-knot fleet supply ship *Fort Duquesne* in Naval trials now taking place in the Channel. The Navy expects to make greater use of helicopters in an anti-submarine rôle, and the present trials are intended to determine the best methods of operating them from merchant ships in different weather conditions.

U.S. Canberras—A Statement

MR. JOHN McCONE, U.S. Under-Secretary for Air, said in Washington recently that the U.S.A.F. would adopt either the English Electric Canberra or the triple-jet Martin XB-51 as a tactical bomber—depending on the result of comparative trials.

Because of the "Buy American" Act, the U.S.A.F. would be unlikely to place its contract in Britain if the Canberra were selected. The aircraft would be built under licence by an American manufacturer—like the Armstrong-Siddeley Sapphire turbojets (to be produced by Curtiss-Wright), which would, incidentally, be convenient alternatives to the Rolls-Royce Avon turbojets now employed in the Canberra.

American sources acknowledge the effectiveness of the Canberra as a medium bomber, high-altitude night fighter or reconnaissance aircraft. Good take-off and landing characteristics and exceptional manœuvrability will be strong points in its favour during the tactical trials—now imminent.

Aviation Newsreel

DESTRUCTION of a Mig-15 over Korea, recorded by the camera-gun of an F-86 Sabre, is shown in a current edition of *British Movietone News* (No. 1129, released last Monday). Aviation is featured in three of the six items in this edition, which shows, in addition to the Mig episode, the arrival of the first B-36s to be seen in Britain (see pages 90-93) and the R.C.A.F. airlift by North Stars from Washington to Tokio. The January 18th edition of *Flight*, incidentally, commented on excerpts from a captured film of Russian aircraft shown recently by British newsreels.

Wind from Water

ONE of the two 17ft-diameter fans has now been installed in the French 120,000 h.p. wind tunnel at Modane, on the Franco-Italian frontier. Power is provided by a water turbine of the type used in hydro-electric generating plants.

Believed to be the only one on this side of the Atlantic capable of testing a full-scale jet fighter to supersonic speeds, the tunnel has a long history. It was planned by the Germans in 1936, and in 1939 they started erecting it in Austria. By 1945, after £8 million had been spent, it was still not complete. When the Americans entered Austria much of the installation

HERE AND THERE . . .

was sent to the United States for examination. It was later returned to Europe at the request of the French, who were confident that they could operate it successfully at the Modane site.

Holland to Ulster

AN advance party—an officer and 77 airmen—of the Dutch naval air squadron which is to be based at R.N. Air Station, Eglington, arrived at the Londonderry base last week, and were due to be followed a few days later by their 12 Fireflies. Protests against the visit have been made by Republican elements in Ulster.

Busy Aeronautical Week

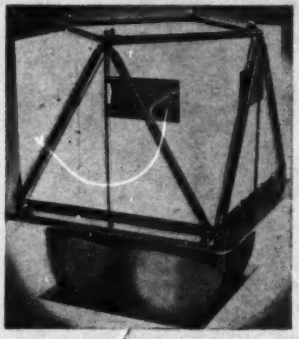
REPLYING to criticisms of the choice of September 11th-16th (Battle of Britain Week) for its Farnborough Display, the S.B.A.C. emphasizes that the decision was influenced by the fact that both the I.A.T.A. annual general meeting and the 1951 R.Ae.S.-I.Ae.S. Anglo-American Conference are both to take place at this period. To hold the Display a week earlier, they point out, would mean inconvenience to hundreds of important visitors from abroad.

The Society "believes its Display need not adversely affect Battle of Britain Week," and adds that "proposals under discussion with the Air Ministry will be of mutual advantage."

Vampires Aid Fishermen

FOUR R.A.F. Vampire pilots recently assisted two Cypriot fishermen to reach shore after a gale off the island's northern coast. Blown out to sea, the fishermen lost their bearings in the mist which followed the gale, and their relatives later contacted the local Assistant Commissioner. He telephoned the R.A.F., who at once diverted four Vampires from range practice to search for the missing men. Although the pilots said afterwards that they did not see the boat, the fishermen said that the aircraft constantly flying from the land out to sea and back again helped them to fix their position and so reach safety.

BEJEWELLED: The most recent addition to the Armstrong Siddeley stable (or dormitory?) of flying test-beds is the Lancastrian with two Sapphires—the most powerful A.S. gas turbine—in the outboard nacelles. Air Service Training carried out the conversion.



SURPRISE PACKET: A model of a 6,000lb-capacity supply-dropping container now under construction at Wright-Patterson U.S.A.F. base. Both men and material may be parachuted in it; the pneumatic shock-absorber bags are inflated during descent.

NEWS IN BRIEF

EMBRACING travel by road, rail, water and air, an exhibition entitled "The Architecture of Transport" is to be held at the Royal Institute of British Architects, 66, Portland Place, London, W.1, from February 22nd to March 22nd.

* * *

F/L. R. T. Townson has joined R. B. Pullin and Co., Ltd., the instrument specialists, as sales engineer.

* * *

Previously technical sales manager of Oddie, Bradbury and Cull, Ltd., patentees of Oddie fasteners, Mr. C. Samuel-Camps has been appointed to the company's board of directors.

* * *

Intended mainly for students, a generously illustrated 36-page booklet, *Mechanical Tests and their Bearing on Working Properties*, has been prepared by the Northern Aluminium Co., Ltd., Banbury, Oxon, makers of "Noral" alloys.

* * *

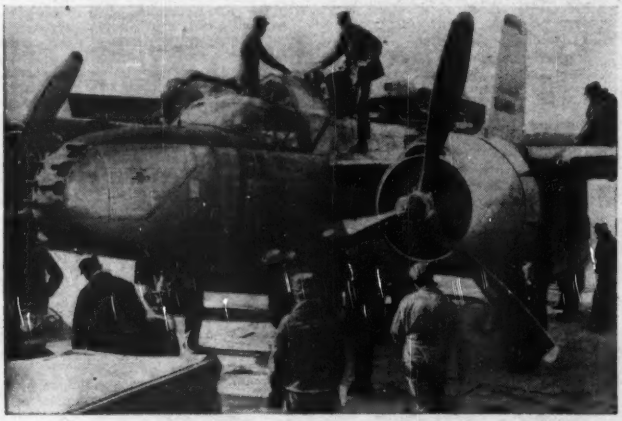
The wide variety of Dunlop aircraft components and accessories is reviewed in a new booklet, *Development for the Aircraft Industry*, published by the company's aviation division at Foleshill, Coventry. Tyres, wheels, braking systems, pneumatic and hydraulic actuating equipment, flexible piping and windscreen wipers are among the items illustrated.

* * *

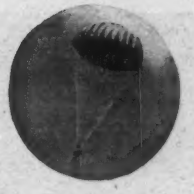
Additions to the range of Hymatic lightweight air hammers are two new models, the PH113 and PH114. They have been intended for duties in which long periods of continuous operation are demanded, and accordingly have spade-type grips and other features designed to reduce operator-fatigue. The Hymatic Engineering Co., Ltd., Redditch, are the makers of these tools.

* * *

Since the General Electric Co., Ltd. (Magnet House, Kingsway, London, W.C.2), published a brochure, in 1948, on their cold-welding process for aluminium and copper, the technique has been further developed. These improved results are dealt with in a new edition of the booklet. The process appears to have distinct possibilities for non-stressed interior fittings in aircraft.



FIRE-POWER: Receiving attention between sorties is a Douglas B-26 Invader, standard light bomber of the U.S. Far East Air Force. This version has eighteen 0.50 guns—eight in nose, six in wings and four in upper and lower turrets—plus bombs and rockets.

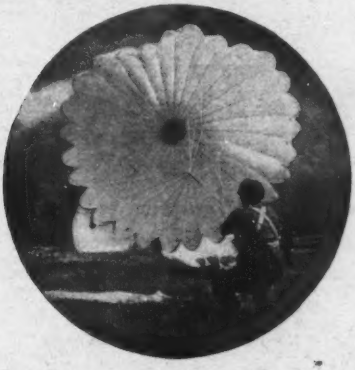


All over the world

men (and supplies)

needing some visible

means of support



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BELGIUM	ECUADOR	INDIA	NORWAY	SWEDEN
BRAZIL	EGYPT	IRAQ	PERU	U.S.A.
	FRANCE	MEXICO	POLAND	

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CREEP CHARACTERISTICS OF NIMONIC 90.

Time & Temperature	°C	Stress (tons/in²) to produce creep extension of 0.1%	0.2%	0.5%	Rupture
100 hour data	650	31.0	33.0	33.5	34.0
	700	24.0	26.0	27.0	27.5
	750	17.0	18.5	19.5	20.0
	815	10.0	11.0	12.0	12.5
300 hour data	650	29.0	30.5	31.0	31.5
	700	21.5	23.5	24.0	24.5
	750	14.5	16.0	17.0	17.5
	815	8.0	9.0	10.0	10.5
1,000 hour data	650	26.0	27.5	28.0	28.5
	700	19.0	20.5	21.0	21.5
	750	12.0	13.5	14.5	15.0
	815	6.0	7.0	7.5	8.0

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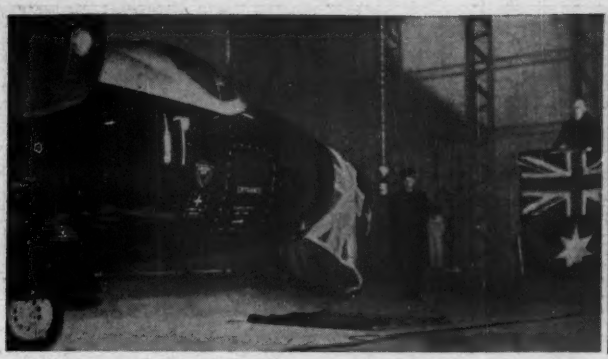


"It is a matter of particular pleasure and great pride that this aircraft has been named Canberra"—Mr. Menzies, the Australian Prime Minister, "christens" the Rolls-Royce-Avon-powered English Electric Canberra (in Australian champagne) at R.A.F. Station Biggin Hill, Kent

CANBERRA NAMED

Australian Prime Minister Officiates at Biggin Hill

A CEREMONY and flying demonstration at Biggin Hill, of Battle of Britain fame, followed by a luncheon at the Savoy Hotel, London, celebrated the official naming of the English Electric Canberra last Friday, January 19th. Mr. R. G. Menzies, in his moving after-lunch speech, neatly summed-up the occasion when he exhorted the British race to take a decent pride in its achievements. That is what all who saw the Canberra—a tactical B. Mk.2 version with Rolls-Royce Avons—felt as Mr. Roland Beamont gave a brief but masterly exhibition of its climb, speed-range and manœuvrability. Mr. Menzies, who had never seen a machine of this type before, was deeply impressed—as, in fact, we believe will be his fellow countrymen who are now preparing to produce Canberras in Australia.

For the record it may be stated that the name Canberra was originally proposed by Sir George H. Nelson, the chairman and managing director of the English Electric Company, who is at present on his way back from a visit to Australia but who was ably represented at the naming ceremony by the acting chairman, Mr. Horsfall. B.O.A.C. had flown-over Australian champagne for the occasion, and station commander of Biggin Hill, W/C A. H. Donaldson, saw to it by careful adjustment and experiment that the bottle swung truly and burst according to plan without harm to the Canberra's shapely nose. All other features of the brief visit to R.A.F. Station Biggin Hill—Guard of Honour, band, refreshments—were managed with similar precision.

Before the actual naming ceremony Mr. Menzies recalled that only "twenty-five years ago the city of Canberra was nothing more than a sheep station on a high plateau with a little stream and a small village church . . . It gave no hint then that it was to become the capital city of a great nation." He continued "It is a matter of particular pleasure and great pride that this aircraft, the latest product of British genius, has been named 'Canberra' after the capital city of a country whose Royal Australian Air Force has made such a great contribution to the safety of mankind."

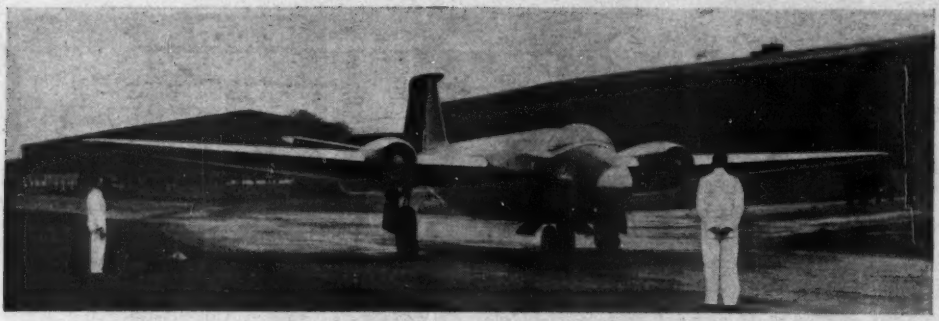
As the bottle swung towards the flag-draped nose, Mr. Menzies wished all who flew in her "happy landings."

The Canberra was then towed from the hangar for the demonstration flight. Among those to take a keen interest in the aircraft and its outstanding performance were Air Chief Marshal The Hon. Sir Ralph A. Cochrane, Vice-Chief of the Air Staff; Members of the Air Council and A.O.C.s-in-C. Fighter and Bomber Commands; A.V.-M. C. B. R. Pelly, Assistant Chief of the Air Staff; and other senior officers including A.V.-M. J. E. Hewitt, Australian Defence Representative and A. Cdre. E. G. Knox-Knight, A.O.C., R.A.A.F. His Excellency, the Hon. Eric J. Harrison, Australia's Resident Minister, and Mr. J. Hanford Stevens of the Australian Department of Supply were also present. A large contingent from the Ministry of Supply was led by Sir Archibald Rowlands, the Permanent Secretary, and Air Chief Marshal Sir Alec Coryton, Chief Executive, Guided Weapons. From the industry came Rear-Admiral M. S. Slattery, managing director of Short Bros. and Harland, Ltd.; Sir Frederick Handley Page; and Mr. J. D. Pearson, director and deputy general manager of Rolls-Royce, Ltd.

Many people regarded the presence of the American party as particularly significant. Among them were Lt.-Gen. K. B. Wolfe, U.S. Deputy Chief of Staff for Materiel, and Mr. C. C. Pearson, president and general manager of Glenn L. Martin. It is with the three-jet Martin XB-51 that the Canberra will compete in forthcoming trials, but it is possible that the size of the requirements in America for tactical bombers will be large enough to justify both types being ordered.

It is learned that the Canberra, which is to go to America for evaluation, is likely to fly the North Atlantic early next month in the hands of an R.A.F. pilot. This will be the first machine of the type to go to North America, but American pilots have flown the Canberra in this country. If America decides to build the Canberra it may be powered by Armstrong Siddeley Sapphires built under licence by the Wright Aeronautical Corporation and more powerful than the Avons at present fitted in the Canberra. Many people now believe that it is almost certain that America will adopt Canberras, even though final tests have still to be made.

The Canberra's climb, as demonstrated by the chief test pilot.



Newly named, the Canberra is started up for the flight demonstration by Roland Beamont,—affectionately described by Mr. Menzies as "the presiding genius who looks just like an Australian tough". His flying was as masterly as ever.

Official inspection, by the Australian Prime Minister, of the Guard of Honour at Biggin Hill.

CANBERRA NAMED . . .

So far as the R.A.F. are concerned, Canberras are likely to be in service this summer, and deliveries have already started. R.A.F. squadrons may start to use examples of the type next month.

The B. Mk. 2 Canberra is a three-seater with bomb aimer's sighting-panel in the nose. Span is 64ft, length 65ft 6in, and height 17ft 7in. During Beamont's demonstration the "finger" dive brakes were seen extended, but it was not possible to observe the use to which the ability to vary tailplane incidence was put.

Two small "mods" were noted which have been added since the Canberra's previous public appearance—a metal fairing behind the cockpit enclosure and a slight increase in rudder area behind the horn balance. The former gives a small constructional and aerodynamic improvement without impairing rearward vision. (The level of the new fairing does not exceed that of the top of the Canberra's gently curving back). The latter—the rudder-area increase—improves stability but is not large enough to be unsightly, although it does interrupt to a small extent the smooth line of the rudder trailing-edge.

In addition to production by the parent company and in Australia, the Canberra is to be built under licence by A. V. Roe, Handley Page, and Short Bros. and Harland—this was announced last November. The designer of the Canberra was not present at the naming ceremony. He is Mr. W. E. W. Petter, who last year left English Electric and took up a new appointment in the aircraft industry.

Speaking as guest of honour at the luncheon which followed the naming ceremony, Mr. Menzies left no doubt as to the impression the performance of the Canberra had made upon him. Apparently speaking without notes, he made what was considered one of his most moving speeches during his visit. Mr. Menzies said: "We meet at a time of enormous anxiety in the world when a potential enemy creates an atmosphere in which everyone thinks he has everything and we have nothing; that he has determination and we have division . . . for a little while we are all conscious of the fact that something seems to have gone out of us. We have had another great war—which could not have been won but for the people of our race, and when it is over we slacken off and we become a little apologetic and defensive, and we discover as usual that when the world lives at peace we have very few friends, but only when the world is in the last desperate condition of danger that we have friends. And that is because it has been our privilege to prove ourselves worthy of that friendship more than once in this century. It is so easy to become dyspeptic, a little dull and a little gloomy. If I needed anything to take me out of that state of mind, I would have had it this morning. Because I want to say that there is only one calamity that can come to us; and that is, if we should lose our decent pride in ourselves and a decent confidence in ourselves. That is the one enemy I fear in this world.

"All around are masses of people, most of them full of sinister ideas. Across the Atlantic we have our great and powerful friend, the United States, with almost three times as many people as there are here. Yet I venture to say that if you take the great art of self-government, if you take the highest arts of war, the highest levels of pure science and applied science, if you search diligently to know from where comes most of the aid to mankind, whether for peace or for war, you can't go beyond these islands. That is a tremendous source of pride to me. Whatever else we do, do not let us lose our faith in our own capacity, nor in our ultimate courage, skill and sensible understanding of the problems of the world.

"It has been a wonderful day. It is a wonderful thing to have that feeling of pride in applied genius for which there is no substitute. No one can destroy this sort of thing by passing resolutions. . . . This country has greater things to do in the world than it has ever done before."

Although the Canberras now being produced are for tactical bombing, the prototype was slightly different, being designed as a high-altitude bomber. Several other duties come to mind for this versatile aircraft, among them intruding, night fighting, low-level marking and controlling on night aids and, as a correspondent points out on p. 114, for photographic reconnaissance.

RECOGNITION CONTEST RESULT

THE West London Aviation Club, scoring 94 marks out of a possible 105, were the winners of the Aircraft Recognition Society's Hurricane Trophy in the annual contest held in London last Saturday. The Society's own team and that of the Barking branch of Air Britain tied for second place with 90 marks. Two of the three members of the winning team, T. Pharo and B. G. Ambrose, scored 33 marks out of a possible 35 and were awarded a special diploma.

Presenting the trophy to the winners, Mr. Peter Masefield announced that the Air League of the British Empire had decided to strike a silver medal which was to be given to the members of the winning team this year and in the future.

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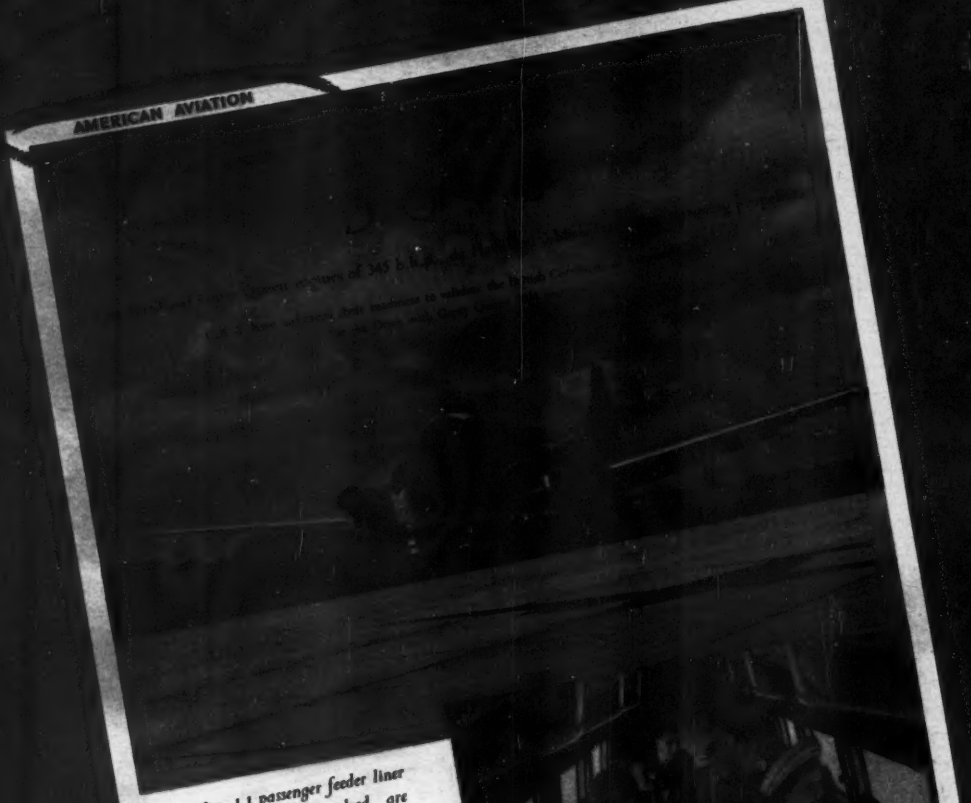

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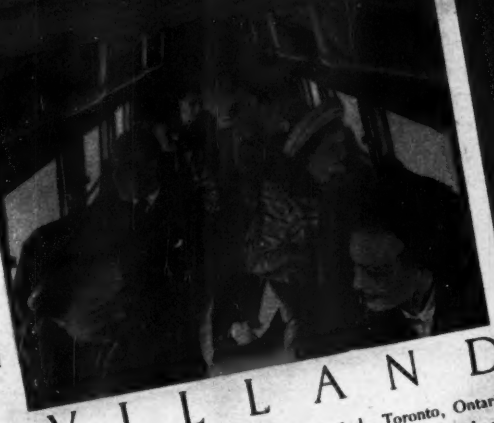

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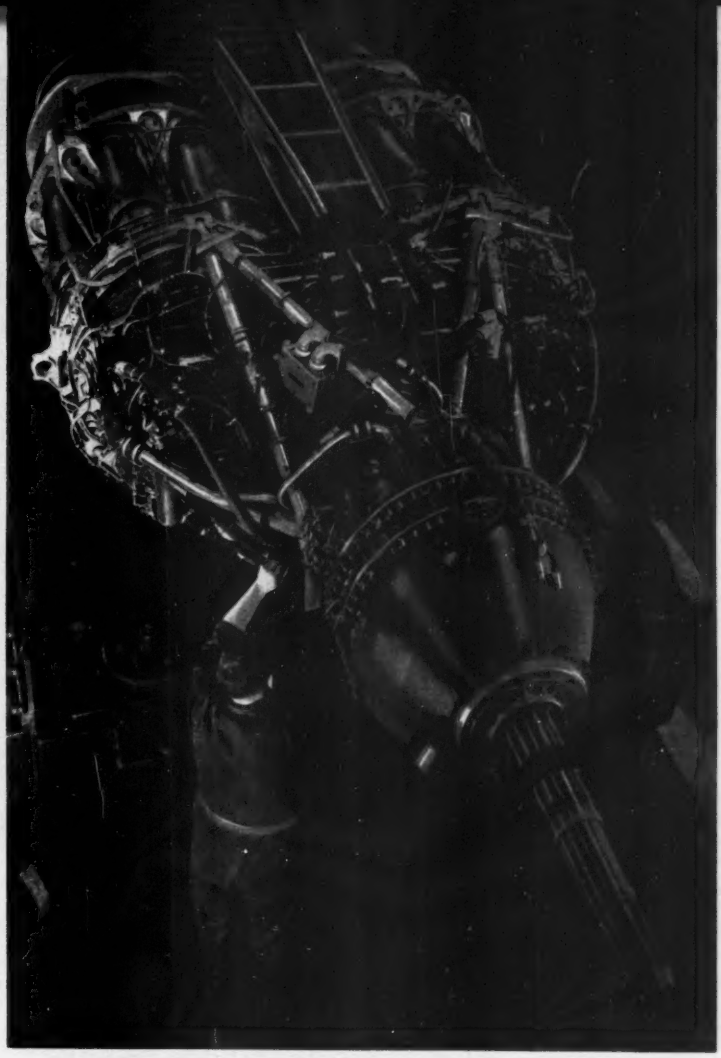
Unequalled experience in the light transport field

AIRCRAFT ENGINES PROPELLERS



PRINCESS AND PROTEUS

IN last week's issue we illustrated the first of the Bristol Coupled Proteus turboprop units for the Saunders-Roe ten-engined transoceanic flying-boats as it left the factory for Cowes. Features of the unit, obscured on that occasion by protective "cocooning," are here displayed to advantage. It will be seen that, although compact for its output (in excess of 6,400 h.p.), the Coupled Proteus bulks large relative to homo sapiens. The accompanying view of the first Princess, however, indicates (by the diameter of the jet-pipe holes in the main spar) that the four Coupled Proteus and two individual Proteus units will be easily disposed within the depth of the wing. The centre-section is seen to be well advanced in construction. In the foreground is the port wing of the S.R. A.1 twin-jet fighter flying-boat.

(Left) A. Cdre. A. D. Davies, C.B.E., A.O.C. Hong Kong. (Centre) G/C. J. Worrall, D.F.C., D.S.C., station commander Kai Tak. (Right) Two squadron commanders at Kai Tak, S/Ls P. L. Arnott, D.F.C., and E. W. Tremlett.

JOURNEY EAST

Part III. Hong Kong and Iwakuni : A Visit to Atom-bombed Hiroshima : Home Again for Christmas

Narrative and Photographs by JOHN YOXALL

IN this third and final article on his recent visit to the Far East Air Force, the Art Editor of "Flight" describes the journey from Singapore to Hong Kong and Iwakuni (in Japan) and back. On the way he passed through Saigon, Okinawa, Luzon and Labuan. The actual route taken and the mileages covered are shown in the map published in Part I (January 11th).

FOR the journey north from Singapore to Hong Kong by a Far East Communications Squadron Dakota (Captain, F/L. Cook) a call was put in for 0300 hr in order to allow for 11 hours in the air and sufficient time to refuel at Saigon in Indo-China and yet for arrival at our destination before dark. The approaches to Hong Kong (Kai Tak) runways are so obstructed by surrounding hills that passenger aircraft are not accepted at night.

Despite the early hour of call, a smiling Chinese amah brought a cup of tea to the bedside, though sandwiches had to serve for breakfast. Almost immediately after take-off we headed out over the sea, and, except for a lurid false dawn above the clouds, there was nothing to see until the coast of Indo-China was crossed three and a half hours later. A well-packed and welcome food-box provided sustenance.

The airport at Saigon houses both civil and military aircraft. While the very latest transcontinental airliners taxi up to the pleasant terminal building, on the other side of the airfield is an assortment of ancient military aircraft typical of much of the present equipment of the Armée de l'Air; it even includes a collection of Junkers 52s which still serve as bomber/transports. It is sad to see the French nation, which once had the largest air force in the world, thus reduced (by discontinuity of government and the upset caused by the change-over to a nationalized industry) to accepting almost any old machine for which the original owners have no further use.

A Martin Mariner and two Short Sunderlands at their moorings off Kai Tak. Above the Mariner's wing-tip can be seen the Lion rock.

After refuelling, our take-off was delayed for a while by a circling Privateer with a front leg which refused to come down. The fire engines and ambulance nipped smartly out to be ready for any eventuality. One was sorry for their crews, who had to spend some time in their asbestos suits in the stifling heat then prevailing.

The rescue services were not required, however, and at 1030 hr, Hong Kong time (clocks were put on 30 minutes for the day's flying), we took off. Like its parent country, French Indo-China is totally cultivated wherever possible, but as we proceeded north-east the landscape changed to one of mountainous jungle.

Soon the Dakota was over the South China Sea again, with nothing to watch except the ever-changing beauty of a cloudscape. At such periods one has time to contemplate some of those wonders of our modern world which we are so inclined to accept without comment. There is, for instance, the wizardry of aerial navigation. Here were we travelling at some 300 ft per second, out of sight of a world below, which, ourselves included, was spinning at right angles to our line of flight with a peripheral speed of nearly 1,000 m.p.h.—yet our place in space could be immediately assessed and our destination reached spot on.

More mundane thoughts intruded when the signaller gave us the cricket scores from the second test match in Australia: England 7 for 28—to be instantly followed by the reflection that some sort of fantasy still prevailed.

At 1615 hr the Dak started to let down from the 9,500ft at which we had been flying and soon we approached Hong Kong—a little early, for the head-winds had proved less severe than had been expected.

The entry to Hong Kong from the air is always impressive, and in clear weather very beautiful, but on this evening there was a thick grey haze to give the terrain a sombre effect. Temperatures were very noticeably cooler than those at Singapore. In early December Hong Kong has rather

Taken from 12,000ft : an infra-red photograph, looking north-east along the coast of China, of Kowloon and the New Territories. Hong Kong island is hidden beneath the wing. The length of the Kai Tak runways lends scale to this illustration.

English-summer-like weather, with hot sunny days and cool nights.

The colony, with the new territories, is roughly 25 miles square, which makes adequate dispersal in war-time something of a problem. The sea frontier is more than 200 miles long. The surrounding hills have set a problem in radar location of hostile aircraft, but this difficulty has now been largely overcome.

The Chinese have an airstrip just over the border and there is an airfield at Canton, 80 miles away. In addition to the civil/military airfield at Kai Tak we now have a satellite airfield at Sek Kong in the new territories. These landing grounds are only ten miles apart but are separated by a range of mountains 3,000ft high. The tortuous road connecting the two includes some 128 sharp bends.

The Sek Kong runway is now in process of being lengthened to 1,800 yards and reorientated to avoid its heading directly into a hill; to extend the original runway would have meant razing the hill.

The main runway at Kai Tak is at present 1,533 yards long but work now being done at its western end will bring the effective length to 1,800 yards. The new portion of the runway will be 50 yards wide. Alongside the runway stand the famous Chinese Dakotas, the ownership of which is still in dispute; unless a decision is quickly reached they will be a liability rather than an acquisition, whichever side wins.

Apart from its civil activities, Kai Tak houses fighter and flying-boat squadrons; it is also a staging post for transport aircraft flying between Japan and Malaya. In addition, there is a target-towing flight of two Beaufighters which work in conjunction with a range at Port Shelter.

The strategic position of Hong Kong is obvious, and its military importance cannot be overstated. At the present stage of aircraft development, especially in regard to range, Hong Kong is dependent on having one other airfield between itself and Singapore to maintain communications. If the French lose Saigon airfield then those available in the Philippines and North Borneo will have to take its place.

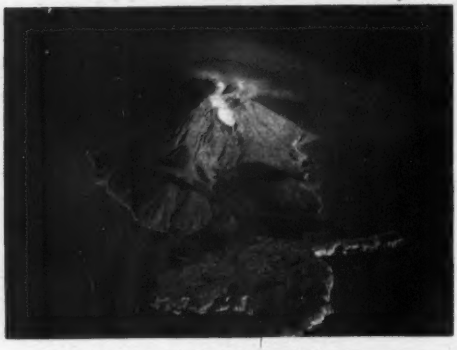
On December 6th the Dakota was prepared for a 0700 hr take-off for the island of Okinawa, with Iwakuni in Japan as the ultimate destination for the day's flying. All passengers were called shortly before dawn and had the experience of watching the wonderful vista of the Hong Kong and Kowloon lights, which give such a characteristic outline at night, gradually replaced by the grey outlines of the hills.

Immediately after take-off we were out over the sea, turning to avoid the hills which come right down to the water's edge. A ship below had on its deck a large painted Union Jack—a grim reminder that it was operating in a war area. Soon the Dak was flying in bump-free, over-weather conditions at 11,500ft.

Shortly after 0900 hr the clouds became more broken and, even from that height, the seas below could be seen to be anything but pacific. Formosa appeared 60 miles or so away on our port beam—for we circumnavigate this island at a considerable expense in extra mileage, lest Russia or Communist China should point a finger at imperialist Britain. Our height by now was 12,000ft and one felt rather light-headed with the continual flying in slightly rarified air. The glare from the sun shining on the polished wing surface, too, proved very trying and emphasized this real disadvantage of the low-wing layout in overweather conditions. At 1145 the navigator came back to tell us we were starting to let down and that all watches should go on yet another 1½ hours—making, in all, nine hours ahead of G.M.T.

By local time we landed at Okinawa at 1320. Naha Air

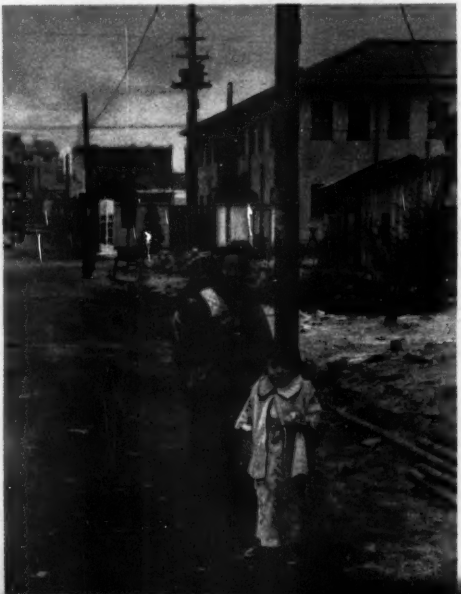
On active service : R.A.F. Sunderlands at Iwakuni, Japan. From here they patrol the Korean coast for mines and submarines.



The 3,316ft volcano Io Shima seen in the low afternoon sun.

The transit camp at Iwakuni is a converted Japanese barracks.

(Above) Air Headquarters at Iwakuni. (Below) A street in rebuilt Hiroshima. There is still much work to be done.



JOURNEY EAST . . .

Base is only 10ft above sea level, and as one looks towards the end of the tarmac the great Pacific rollers appear to be a good deal higher than the intervening ground.

Although the Americans have held Okinawa since they captured it with such great loss of life in June, 1945, the base is still very temporary in character. Nissen huts, suffering sadly from rust, provide most of the accommodation but there is a very comfortable little canteen where pale-blue-clad young Okinawan girls serve the visitor with a variety of good food. Naha is essentially a military air base—one sees rows of black-painted ultra-long-range Twin Mustangs and F-80s at the dispersals; it is also a transport staging-post. Civil airliners, however, do use it as a refuelling point. B.O.A.C. Argonauts sometimes call in if take-off conditions at Kai Tak have prevented a full load of fuel being taken on board. In the opposite direction, stops are made if a full load of passengers and mail preclude the carrying of sufficient petrol for the through journey from Japan to Hong Kong.

An hour and a quarter after landing—men and machine having refuelled—we taxied out for take-off and were soon heading out over an intense blue sea. Behind us lay derelict tanks stuck at crazy angles in the sea shore—remnants of war, and a number of rusty ships' hulks, the legacy of a tornado—Okinawa is known as the home of the big winds.

We went to 10,000ft up through 8/8ths cloud again and could see nothing of the many islands which the map told us must be passing beneath us. Two hours out, the snow-clad mountains of Yaku Jima (6,348ft) appeared on the starboard bow and later, as the cloud below dissolved into the cooler air of the late afternoon, we passed over the volcano Io Shima (3,316ft) which has an active crater nearly as big as the island on which it stands.

Our day's journey having been largely in a northerly direction, the winter sun was very low as, at 1700 hr, we passed over the Japanese coast at Makurazki on the southern island of Kyushu. The low sun-haze cast a peach-coloured veil over the whole landscape, giving a delicacy to the aerial vista comparable to that of a Japanese print. It is difficult to believe that such exquisite surroundings

could have cradled a nation of such cruel little men.

Darkness fell and our navigator confirmed that Japanese time is nine hours ahead of G.M.T.; he gave us an E.T.A. of 1815 hr. The cabin became colder for a while but the excellent heating arrangements on the Dakota soon restored equable conditions; in fact, it became a trifle too warm before we put down at Iwakuni some minutes ahead of our E.T.A.

Iwakuni is a British and American military air base, situated at the south-western tip of the island of Honshu and in the prefecture of Hiroshima, of atom-bomb fame. Apart from its employment as a staging post for Transport Command it is the operational home of two R.A.F. flying-boat squadrons under the command of W/C. Burnside, D.S.O., D.F.C. It is from here, also, that the Americans send off their B-26s on night interdiction sorties to Korea.

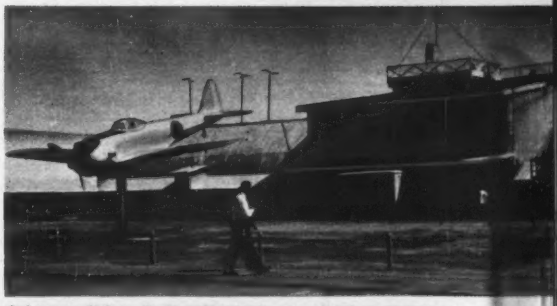
In the Far East there are three squadrons of Sunderlands, one stationed at Hong Kong and two at Seletar air base on Singapore Island. These units take turns in going up to Iwakuni to do patrols along the coast of Korea. Depth-charges are carried, but the main purpose is to seek out sea mines which, it is suspected, are being laid by Chinese junks rather in the same manner as that employed by fishing boats during the Spanish civil war in the nineteen-thirties.

The Sunderlands work with two squadrons of U.S. Martin Mariners, also stationed at Iwakuni, and it is usually left to the Mariners to destroy any mines found, as they carry heavier armament. Patrols last from 10½ to 12 hours. While back at Seletar base the Sunderlands do anti-bandit bombing with large numbers of small bombs in the manner referred to in Part II of this article.

Despite the age of the Sunderlands—most of them are over six years old—their serviceability record is good. Like all other aircraft in the tropics, they suffer from electrical faults caused by the damp heat, but there is no excess of corrosion of bottoms. After 800 hours' flying they are flown back to Britain for overhaul. Each crew then collects another boat and flies straight back. It is a great tribute to these aircraft that they should be giving such excellent service—their take-off characteristics and performance are considerably better than that of the Mariners—yet the basic design—that of the Short C-class flying-boat, is more than fifteen years old. Certainly, as they sit at their moorings they look quite modern.

Although the stay at Iwakuni was so brief, an opportunity was found to visit Hiroshima and check on the many reports, sentimental and otherwise, which have emanated from that city. The devastated area is completely built-over again, but this work must not be confused with re-building as we understand it. A large proportion of the rebuilding is of wooden-shack construction which we would not tolerate even as temporary accommodation. The whole area, and the scars from the explosion, have been commercialized for tourists' benefit. Large posters declaim "Peace,

(Above) English as she is wrote in Hiroshima railway station. (Right) The peace memorial situated in front of the skeleton of the Industrial Exhibition Hall, which marks the centre of the atom-bomb damage area.



A Japanese "Oscar" decorates the forecourt of Clark Field Headquarters, near Manilla, on Luzon Island, in the Philippines.

(Above) In the grand manner—the airmen's mess at Clark Field. (Below) Typical mountainous terrain in the north of Luzon island.

From a local guide-book on atom-bomb effects in Hiroshima: the city in 1945, just after the bomb was dropped, compared with the same area in 1949 after rebuilding.

Crossing the harbour on the way in to the Labuan airport, North Borneo.

The street and Sultan Mosque in Singapore, where riots first broke out

JOURNEY EAST . . .

Peace—no more Hiroshimas," but one's sympathy is tempered by the knowledge that the Japs tortured and drove to death many more people than the thousands that died instantly, with no apprehension of death, in Nagasaki and Hiroshima.

It is, of course, interesting to see the results of the atom-bomb flash. Polished granite that had faced the explosion is rough and pitted. House tiles show traces of the surface being actually fused except where covered by another tile. A man—probably a beggar—sitting on the stone steps of the Osaka Bank at the time of the explosion has left his shadow outlined where he sat. His body protected the granite from being etched by the flash.

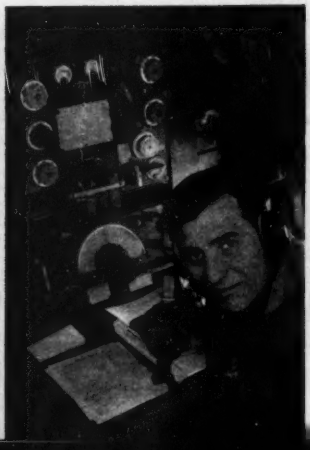
At 0710 hr on Friday, December 8th, we started back for Hong Kong. Take-off was delayed for ten minutes because the weather map presented to the aircrew 30 minutes previously was already out of date. Obviously there were some big changes about.

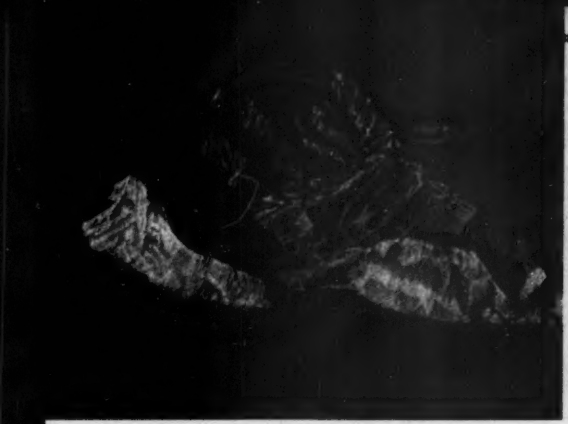
The Dakota was soon airborne and up to 8,000ft, but no sign of earth or sea was visible during the intervening hours until we broke cloud at 300ft, at the end of a G.C.A. let-down over Okinawa. After refuelling we could not get clearance for continuing the flight to Hong Kong. On the synoptic chart the lines of isobars followed almost exactly the course we had to take to Kai Tak. A head-wind all the way was forecast, of over 30 knots, so it would be impossible for the Dak to get in before dark. We were anxious to get back to Singapore by the Saturday because, although an international airport of considerable importance, Saigon is closed by the French for the whole of Sunday. It was therefore decided to stay in what the Americans are pleased to call their "transient" camp, making a fresh start at 0115 hr the next morning, with the intention of completing the whole journey back to Singapore on the same day. This seemed a workable arrangement (though a bit hard on the crew) and most of us lay down for a few hours, listening to Naha living up to its reputation for big winds.

At the time for take-off the weather had cleared considerably but the wind was still high. As soon as we were airborne everyone who was able to do so continued to get in a little sleep in prospect of the long day ahead. All went well until 0700 hr when, about one hour's flying out from Hong Kong, a signal was received diverting us to Laoag in the Philippines. At Hong Kong, apparently, a wind across the runway was gusting up to 60 knots. Later it went considerably higher, approaching typhoon force, and seven aircraft were seriously damaged. One of these was another Dakota which had left Okinawa the previous day, 30 minutes ahead of our original time of departure, and was the last aircraft to be accepted by Kai Tak.

A qualification of our diversion to Laoag was the request that if we had enough fuel we were to proceed to Clark Field, about 60 miles N.W. of Manilla. Actually we had plenty of fuel on board, because the long-range tanks had been filled at Okinawa and ultimately we finished with sufficient over for four hours' flying. At Clark Field there was a very warm welcome; Major McClean of the U.S.A.F. met us and provided shower baths and breakfast when we landed at 0920 hr (0820 local time). In the short while at our disposal Major Wachtell, the station public relations officer, took the trouble to show us round the magnificent camp. Clark Field is just as pretentious as Naha is unpretentious

Crew of Hastings TG 531: Left, F/L. J. A. Martinson (captain); bottom left, Sgt. V. R. Rust (navigator); below, Sgt. N. H. Mullen (flight engineer); right, F/Sgt. A. R. Lyons (wireless operator).





Half-way home : Part of the inhospitable coast of Trucial Oman.

Crossing the snow-covered Jura mountains in the south of France.

and when the Americans think big they do a big job. Some of the accompanying photographs will show how well they have succeeded. The station houses fighter/bomber and P.R. squadrons. The first are primarily to show the U.S. flag over Formosa and the latter is engaged on an extensive remapping programme. In addition, the station is responsible for all U.S. Air/Sea rescue work, right up to Japan.

For all its long-range qualities the Dak could not make the remainder of the journey across the South China Sea to Changi (Singapore) in one hop and so we were routed via Labuan in North Borneo.

Despite the time taken for an inspection of a suspected oil leak we were away again by 1130 hr (local time) flying over the tropical green landscape of Luzon and leaving Mt. Natib (4,322ft) on our left. Here, as elsewhere in the tropics, one saw below brilliant reflections from some of the roofs, for all the world like those seen when flying over the greenhouse areas of Guernsey or the Lea Valley. There is, of course, no need for glasshouses out here, where the whole atmosphere is moist and rarely falls below a temperature of 75 deg F. The reflections are, in fact, from corrugated-aluminium roofs, which have been found to keep the houses cooler by reflecting the heat rays. This is interesting in view of the fact that some of the airlines now cover the bare aluminium of their fuselage roofs with white paint in order to obtain the same result.

Navigation for this leg of the journey was simple, for the coastline of Pelawar island ran parallel with the line of flight for over 200 miles. By 1450 hr we were running down the N. Borneo coast, which was obscured by such thick cloud that Mt. Kinabalu (13,457ft) only just peeped out at the top.

Eleven minutes after the original estimated time of flight of four hours we landed on the coral runway at Labuan* and were greeted by the station commander, F/O. G. Meyrick.

After a speedy refuelling by Shell we set off on the third leg of the day—Labuan to Singapore. For this we took off at 1655 hr, half-an-hour ahead of Singapore time. Cumulus clouds made conditions rather bumpy for a while and after an uneventful flight of 4 hr 50 min over the South China Sea we were letting down at 4,000ft in the midst of a violent thunderstorm and pelting rain.

The Dak rattled along the Marston steel runway at Changi at 2130 hr, after the longest day's flying I have ever done.

With a few days to spare before starting the return journey to England it was thought that Singapore city and island might be explored. But this was not to be; on the very next day after our arriving back from Japan, the riots broke out. Religious in basis, they concerned the annulment of the girl Bertha Hertogh's marriage to a Muslim, and, to add fuel to the fire, putting her in the charge of a Christian convent.

The troubles bore no relationship to the Communist banditry but, of course, as soon as the affair started the bandits cashed in on it. A curfew was enforced and all ranks of the R.A.F. were confined to camp during the hours of darkness. In the daytime weapons were carried by all ranks when outside their camps.

There would in any case have been much excitement on a journey home from the Far East—many of the passengers had been away for over two years—but having regard to an expected arrival in England a day or two before Christmas expectation ran a good deal higher than usual. The many and various presents being brought home for the festive season made the inside of Hasting TG531 look rather like Santa Claus's sleigh. No trouble of any sort was experienced with either the engines or airframe on the 8,000-mile run home. Five times we refuelled with some 2,000-odd gallons of petrol for five days' flying in perfect weather conditions. Everything went to schedule.

The first touch of winter was seen at El Adem, in North Africa, where there was a log-fire in the transit mess; the snow-covered Jura mountains in the south of France next gave indication of weather conditions to be expected in England.

The touch-down at Lyneham was made in the wintry sunshine of the year's shortest day and very soon the Customs officers were trying to cope with a variety of parcels and goods which had to be seen to be believed.

Swindon station was blacked out as the result of a power cut. Nevertheless, by candle-light, toasts to a happy festive season were drunk before the party dispersed to their various destinations.

England once more : Air Quartermaster Sgt. Nicholls opens the door as Hastings TG 531 taxies in at Lyneham.

* *Labuan airport was the subject of a separate article in "Flight" for January 4th.*

Fitness for Duty

Work of the R.A.F. Institute of Aviation Medicine

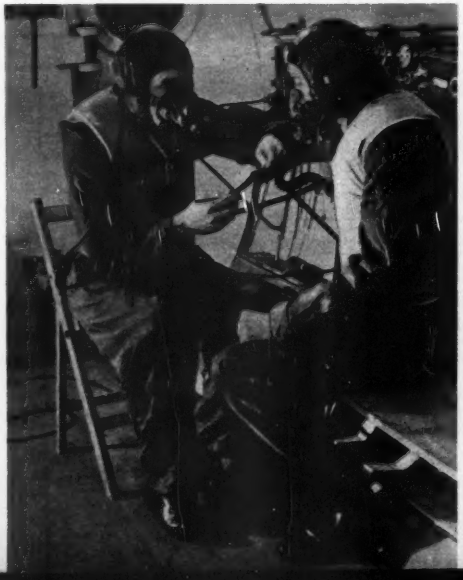
WHEN thinking of development in aviation, one tends almost automatically to concentrate on airframes, engines and auxiliaries. One rarely considers man—perhaps because man, as such, is less readily capable of development: true, he can be educated and can be trained to a high pitch of physical fitness, but in the latter instance at least, optima are quickly reached.

During the last few years, the operational capabilities of military aircraft have advanced to a level at which it has become increasingly necessary for serious attention to be paid to the human factor. The human body is a magnificent mechanism which, although in some ways is astonishingly delicate, is nevertheless capable of accepting a great amount of maltreatment without becoming permanently impaired. But this elasticity is not infinite, and if demands are made of man beyond his, so to speak, elastic limit, then it becomes necessary to equip him with means of compensating the effects incurred. Hence ejector-seats, pressure cabins and air-conditioning, and g-suits, pressure waistcoats, ventilated suits and other items of specialized clothing, and so on and so forth through an almost fantastic gamut of equipment.

Farnborough is a name which, throughout the aviation world, is synonomous with research and the esoteric labour which furthers man's dominion of the air. It is but fitting, therefore, that as well as being the locus of mechanico-physical experimentation, it should also be the home of physiological and psychological research upon flying man. The foundation of an aviation medical establishment is comparatively recent: it was in 1939 that the Flying Personnel Research Committee was formed to investigate physiological problems arising particularly from high-speed and high-altitude flight. In the same year, the R.A.F. Physiological Laboratory staff started research at the Royal Aircraft Establishment, Farnborough, in association with the R.A.E. and the Applied Psychological Research Unit at Cambridge University. In 1945, the Laboratory was renamed the R.A.F. Institute of Aviation Medicine, and its scope widened to serve not only the Royal Air Force, but Naval and civil aviation as well. Perhaps the most appropriate definition of the function of the I.A.M. was that given by Air Marshal Sir Harold Whittingham, who is chairman of the Flying Personnel Research Committee. He said, "aviation medicine is concerned with all those psychological and physiological attributes that enable a man to fly under various atmospheric conditions, at considerable altitudes, by night or day, in pressurized or non-pressurized aircraft, at high speeds and with great forces of acceleration and deceleration. It includes many visual, auditory and stress problems. . . ."

Of the Service and civilian research staff of the Institute, about a third are R.A.F. medical officers; three are pilots and one is a navigator. The C.O. is a group captain, but for professional as well as for security reasons it is not permissible to divulge names. Security also makes it necessary to gloss over some proportion of the work at present being undertaken at the Institute.

Whilst the I.A.M. has its own fleet of five aircraft whereby full-scale factual experiments can be conducted on various items of equipment, a great deal of research work—particularly that of an empirical nature—can, obviously, be carried out more conveniently and much less dangerously under simulated conditions. The largest piece of equipment at present in use in the laboratory is a duplex low-pressure chamber, divided into unequal volumes by a bulkhead, the smaller chamber being about 10ft long against the 15ft length of its larger complement. The diameter of the chambers is 9ft, and the interior is lagged with white felt as an anti-condensation measure. Evacuation of the chambers is made into a third cylindrical chamber housed outside the laboratory and evacuated in turn by means of a battery of commercial-type vacuum pumps. It is possible



(Left) Two medical officers are here seen in the small low-pressure chamber. The distention of their pressure-waistcoats indicates the low pressure inside the chamber.

(Right) This officer is wearing the new flying helmet and oxygen-mask, the new flotation jacket, the new pressure-waistcoat, the new trouser-blouse overall, and the new mukluk snow-boots.

"Flight" photograph.

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(Left) This photograph shows the connection between mask and pressure-waistcoat, and also shows how the hood of the cold-weather blouse can be worn over the flying helmet to afford added protection to the face and neck.

(Right) Detail of newly-developed flying helmet with modified earphone installation. The new vizor is shown in the partly raised position, where it would serve as an efficient sunshield. *"Flight" photographs.*

Fitness for Duty . . .

to evacuate the chambers down to a pressure-equivalent of 40,000ft (5.55in Hg or 2.72 lb/sq in) in approximately four minutes, but it takes considerably longer to attain the maximum depression of 0.75in Hg which is equivalent to an altitude of about 76,000ft.

Control valves permit a variety of conditions to be simulated: for example, high-speed climbs and descents through any required ranges of altitudes; stabilized altitude conditions; gradual decompression; rapid decompression; explosive decompression; and so forth. The last-mentioned condition is simulated in an ingeniously simple manner. In the bulkhead dividing the two chambers is a doorway and an observation port; the doorway is, of course, closed, and the normal ¾in-thick armoured-plate glass of the port is replaced by a diaphragm of special paper. The test specimens, human or otherwise, are accommodated in one chamber, which is evacuated down to the equivalent altitude of the aircraft's pressure cabin; the complementary chamber thereafter continues to be evacuated until it reaches the equivalent altitude at which the aircraft is assumed to be flying, whereupon the paper diaphragm fractures, and the test specimens are consonantly subjected to virtually instantaneous decompression.

Along each wall of the chambers are bench seats and tables, oxygen supply points and regulators, intercomm sockets and, above, a line of observation windows, 15in in diameter and glazed with armoured-plate glass. In the larger chamber is an X-ray seat station, and an ingenious optical system—devised at the Institute—pierces the end-wall of the chamber and permits the subject to be X-rayed by means of the radiographic unit outside the chamber.

It will be appreciated that before designing equipment suitable for operation in given conditions, it is necessary for the physiological effects of operation at those conditions to be established. In many instances, a good deal of data exist, but even so, the research staff of the Institute are frequently required to act as guinea-pigs. There is no question of "you will volunteer"; it is simply that the man or men chiefly concerned with a particular piece of research naturally use themselves as means of gathering data. There is a great deal to be said for this, cold-bloodedly heroic though it might appear and, on occasion, undoubtedly is; reduced to essentials, it is simply confirmation that an ounce of experience is worth a ton of theory.

In the photograph on page 104 are shown a couple of medical officers in the small low-pressure chamber, each wearing the new-type pressure-waistcoats and oxygen-masks developed in conjunction with the R.A.E. and M.O.S. They are close-fitting garments of two-layer rubberized-fabric with a zipp front. At the right breast is a light-alloy junction-box into which the oxygen lead from the source of supply is connected, and from which the flexible trunk up to the mask is taken; the junction-box is open to the inter-wall volume of the waistcoat. An exhaust valve is embodied in the oxygen mask, and opens at a fraction above the pressure-value of the system supply: thus the wearer breathes "through" the waistcoat. A moment's consideration will suffice to show that the pressure waistcoat provides a local ambient pressure around the lungs to give a state of working balance comparable with that normally enjoyed.

Clothing and specialized items of personal equipment naturally claim a large measure of attention in the work of the I.A.M. A new type of flying helmet has been devised, and an exceedingly comfortable piece of headgear it is. Service pilots will be glad to know that the bulky and cumbersome insert earphones have given way to compact little units which are housed in snugly comfortable noise-excluders of astonishing efficiency. The oxygen mask and microphone have also been given a good measure of attention and —an excellent point—the microphone is connected by a short cord to a junction-box carried on the lower left side of the helmet, the long intercommunication lead being taken from the junction-box.

Work is also going ahead on a vizor to take the place of goggles. Carried on a shock-absorbing headband, the vizor takes the form of a curved piece of transparent Perspex, dyed to a neutral grey. A friction-clamp butterfly-nut permits the vizor to be locked at any required position between the fully down and the fully up (out of use), and the neutral darkening of the Perspex is such that it provides utility as an anti-glare sunshield without destroying colour-definition.

Whilst on the subject of headgear, it is worth mentioning that the Institute views with some reserve the plastic-basin "crash-hats" issued to American fighter pilots. The view is taken that such helmets, by virtue of their weight—and it is exceedingly difficult to make them really light—can impose an unwarranted load on the wearer's neck during high-g manœuvres; that protection for the head against bumping the canopy is better left to the efficient design of seat and harness; and that protection from getting hit by a canopy during its jettison is also better left to the sense of the pilot to duck his head when freeing the canopy. On the other hand, if loss of the hood is unpremeditated, the

Demonstration of new flotation jacket, illustrating the fact that partial inflation does not distend the wearer's harness.

Fitness for Duty . . .

safety of the pilot's skull is best assured by aerodynamic design which ensures that the hood leaves the aircraft cleanly.

Survival equipment can be seen at the Institute in such a bewildering variety of forms that we can do no more than pick out a few representative items for mention. One that immediately springs to mind is a new type of flotation jacket to supersede the Mae West of honoured memory and service. Two of the primary requirements of a flotation jacket are (a) that it should support the wearer in such a fashion that his head is kept comfortably above water, and make it impossible for him to be supported face-down, and (b) that partial inflation of the jacket should not distend either parachute or seat harness to such a degree that operation of the locks is impaired. The new flotation jacket is rather like an upper-torso waistcoat with a zipp front and skirt belt-adjustment, and with a rubberized horseshoe-bladder around the neck. The "horns" of the bladder are semi-free so that, if the jacket is partially inflated during a parachute descent, the harness is not distended. Once in the water, the wearer can free his harness in the normal fashion and, by pulling on a nylon webbing strap running up from the waistcoat through friction buckles at the tip of each horn of the bladder, can pull down the horns close to his chest. In this condition, the design of the jacket is such that the wearer is supported in the water at an angle of approximately 45 deg, with his head held clear of the surface. Such an angle has been proved to be the most effective in that it decreases to a minimum the likelihood of the wearer's bobbing beneath the surface, and succumbing to sea-sickness as a result of wave-motion.

The bladder is inflated by pulling off the cap of a CO_2 bottle carried at the side of the left-hand horn; a mouth-tube with a screw-valve is also provided for topping-up inflation if such should be necessary. At the side of the right-hand horn is stowed a pack of fluorescent stain for sea-marking, and also stowed on the right-hand side of the waistcoat is a pack containing a salt-water-activated battery for the position-marking light which the survivor wears on a band around his head. Another pocket in the vest houses a rubber helmet to afford the survivor's head some degree of protective covering.

Survival equipment of a very different kind also devised and developed at the I.A.M. is cold-weather clothing, more particularly for aircrew, but with obvious inferential applicability to other occupations. Working from the skin outward, the garments are, first, a Brynje vest and long, loosely fitting underpants. The Brynje vest forms the basis of all cold-weather clothing assemblies. Air is one of the most efficient of insulating media, and the wide mesh of the cotton cord of the Brynje holds air in contact with the skin and allows it to circulate. The odd thing is that the Brynje vest is also a first-class garment for tropical wear as well, the circulation of air implicit in the construction of the vest precluding hot areas under clothing, whilst at the same time affording ventilation.

A cold-weather flying overall for use in the air and on the ground by aircrew operating from cold-weather bases has been devised. It is essentially two garments—trousers and blouse (or inner parka)—which have been combined together to make an overall, this being more effective under flight conditions. The trousers are suspended on hook braces to relieve weight on the blouse. The blouse is provided with a simple hood, closed by elastic at the sides, and so designed that it can be pulled over the flying helmet to give added face and neck protection under cold conditions. As issued, the trousers and blouse are fastened together with buttons and by stitching around the skirt, but may be separated into individual garments by undoing the buttons at the waist and ripping the hem-stitching.

A thigh-length hooded coat, or outer parka, has also been designed to provide additional insulation for the severest conditions. The hood, closed by a draw-cord, is designed to protect the face under conditions of high wind chill, and the hood opening embodies a soft-wire rim which can be bent into any desired shape. Protection from wind chill is effected chiefly by an extensible cowl in the hood, edged with wolverine long-haired fur, which assists in preventing wind reaching the face, and from which condensed breath can easily be brushed off.

Protection against severe cold is a good deal more easily effected for the body than it is for the hands and feet. For hands, the I.A.M. has experimented with long woollen wristlets which drop over the thumb, index and little fingers, leaving the palm bare, but covering the back of the hand. These are extremely effective in keeping the hands warm, and enable fitters to work for long periods with their hands otherwise exposed. Inner mitts of wool are warmer than finger gloves, but are useful chiefly for ground-survival conditions. Outer mitts complete the hand assembly. These are made in the shape of the relaxed hand, and are of soft leather which permit them to be used under widely varying conditions. The backs are covered with wool-pile, not for protection but for nose-wiping; handkerchiefs are impracticable in cold conditions, and the nose tends to "drip." The wool-pile also provides a means of warming the face in the event of frost-bite: by placing the pile against the affected part, local insulation is provided which allows heat coming from below to thaw out the frost-bite.

(Continued on page 107)

(Left) In the water the flotation jacket supports the wearer comfortably at an angle of about 45 deg.
(Centre) The wide-mesh cotton-cord Brynje vest is ideal for extreme climates.
(Right) The hem of the cold-weather flying blouse is stitched to the trousers to form an overall, but can easily be separated.

"Flight" photographs.

The new H.P.R.2 training aircraft fitted with the Alvis Leonides engine

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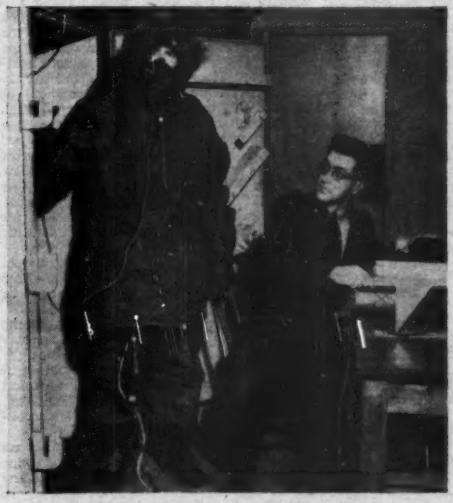
FITNESS FOR DUTY . . .

In addition to the mitts and wristlets, working gloves have also been designed in cotton-backed and wool-backed variants. Both are intended for normal use under not very severe conditions and for survival use in camp.

The footwear devised for dry-cold conditions consists of three pairs of socks, sized to fit over one another without creases; a duffle sock made of felt-like blanketing, and in appearance more like an adult version of a baby's bootee than anything else; a felt and velour insole to provide effective insulation beneath the foot; and, finally, a mukluk. This last is a rubber-soled canvas-topped boot, which is laceclosed. The sole is ribbed to give good traction on snow.

Another item of specialized clothing, but this time at the other end of the scale, and not protective in the ordinarily accepted sense of the term, is an air-ventilated suit. In the tropics, the maintenance of skin temperature at equable levels is no mean problem; if a fighter pilot has to sit at readiness in a cockpit the temperature of which may be torturingly high, his efficiency as a fighting unit will be negligible unless means are provided to alleviate his discomfort. A comparable problem exists in flight at high speed, as a result of the kinetic heating of the fuselage conjointly with the stuffiness of the specialized clothing, life-jacket, parachute harness and so forth which a pilot must wear, and which all tend toward increasing his skin temperature to unacceptable levels. To meet these requirements, a suit has been devised which, made of nylon, incorporates an arterial system of plastic tubes that diffuse cool air at no fewer than 92 points throughout the garment. By supplying cooled air at 85 deg F to all parts of the body where perspiration is most pronounced, skin temperatures can be brought down to comfortable levels within a few seconds and, in that cooling is achieved by evaporation of perspiration, inherent "automatic control" is achieved—that is to say, if the wearer is not perspiring, no cooling takes place. Air supply for the suit is tapped from the cabin-supercharge system at approximately 12-15 cu ft/min, and 7½ lb/sq in; until such time as cockpit refrigeration becomes general, the air will be piped through the coil of an ice/water cooling box.

The effectiveness of the air-ventilated suit has been amply proved by tests conducted in the Institute's hot room, a scientific *hammam* where the discomfort of high temperatures can be emphasized by feeding-in varying values of relative humidity. This chamber has its opposite number just down the corridor—a cold room where the temperature can be lowered to −55 deg C (by a methyl-chloride refrigerating system), whilst at the same time, winds up to 30 m.p.h. can be artificially created, and pressure be reduced to an altitude equivalent of 75,000ft.



The officer is seen emerging from the cold chamber where, for two hours he had experienced —40 deg C, his body temperature having been recorded by his fellow M.O. outside the chamber. He is wearing the new outer parka with fur-edged wind-cowl hood.

The ventilated suit embodies a system of conduits terminating at 92 outlets for supplying cool or warm air to critical areas of the body.

Having dealt at some length with certain of the finite results of the Institute's work, we must now content ourselves with indicating the scope of its interests by taking a random example of laboratory equipment. Electrics and electronics play a fairly large part in almost all physical research work today, and in the electronic laboratory of the I.A.M. have been built a variety of exceedingly interesting items of research equipment. Not the least of these is a device whereby the purity of water can be checked. For certain chemical experiments it is necessary that water of ultra-high purity be used; it is obtained by passing distilled water through filters of activated resins. Obviously, it is desirable that some means should exist whereby the effective life of these resins can be assessed, and the purity of the product-water measured. An instrument for this purpose has been developed which, by the intermittent flashing of a light bulb, automatically signals when the ultra-pure water becomes in the slightest degree contaminated.

We have also made brief reference to the five aircraft used by the Institute; these are a Meteor 7, a Spitfire 22, a Vampire 5, a Mosquito T3, and a Harvard. The Meteor 7 is used for general high-performance work, and both seats are equipped with anti-g valves for use with g-suits. Ultra-sonic vibration is also studied in this aircraft, the results being analyzed electronically. The Spitfire is used chiefly for high-g work; it is so strong an aircraft that it is eminently suited to this field. The Vampire 5 has been used for the development of g-suits served by tappings from the engine compressor, and also for the development of the air-ventilated suit supplied with air from the same source. The Mosquito is used for the development of a system for recording pilot efficiency in instrument flying, and also for extracting values of individual instrument design. The aircraft is equipped with S.B.A., I.L.S. and Y.G. (U.S. Navy letter-sector-beacon system), and is fitted with amber screens for use with blue goggles to simulate blind flying; dual control is fitted for a "safety pilot." The Harvard is a general-purpose aircraft which is used for transport and for instrument flying practice.

The fact that the Institute has its own aircraft is regarded as a matter of very real importance in that it keeps the research personnel genuinely air-minded and in real touch with their work—in short, when a man air-tests a piece of equipment he has been working on, he is not likely to take a remote, academic view of the work. C.B.B-W.

FIGHTER ARMAMENT

By

A. R. WEYL, A.F.R.Ae.S.

Le Prieur anti-Zeppelin incendiary rockets on a Horace Farman biplane in 1916. They were stick-stabilized and used a black-powder propellant.

PART VII : *Simple Rocket versus Guided Missile—and Some General Conclusions*

In the first of this series (August 24th) Mr. Weyl reviewed the history of aircraft armament; in the second (September 21st) he discussed German equipment; in Part III (October 5th) he analysed the respective claims of guns versus rockets; on November 23rd he dealt with the effectiveness of various types of shells and fuses; in Part V (December 7th) he analysed Luftwaffe combat experiences, particularly with the use of the R.4/M air-to-air rocket missile; and on January 4th he dealt with some further aspects of gun design, discussed sights, and showed how installation problems indicate the use of rockets rather than guns in the newest interceptors. In this final instalment he suggests that the guided missile is not yet the answer to the interception problem and concludes by summarizing his views on our past and present aircraft-armament policy.

THE majority of artillery rockets now used in surface warfare, or from the air, are subsonic. Most of the present *supersonic* rocket missiles are large, and intended as guided missiles of the "aerial-torpedo" variety. Small supersonic rockets, used operationally in numbers (i.e., as salvos, bursts, or salvo-bursts) are still rare and, apart from the German R.4/M, repeatedly mentioned in this series, little developed.

The unrotated and the spinning types of rocket missile differ basically, the former having fins for stability in flight. The latter usually has helically disposed discharge nozzles; during the burning period, the ratio of angular velocity to translational speed remains practically constant.

Generally, it seems established that, for high-velocity, air-launched missiles, the unrotated finned rocket gives the smallest dispersion. The R.4/M is not only of this variety, but has folding fins, a feature now often adopted (e.g., in the larger, homing edition of the R.4/M about to be introduced by the Americans for jet fighters). Before launching, the fins are folded back against the concave portion of the nozzle, like blades in a pocket knife; when the missile leaves the cardboard launching-tube in which it is packed and conveyed to the launcher, the fins spread. This arrangement greatly facilitates storage, handling and feeding.

For small, plain rocket missiles, solid propellants, based on smokeless powders, are preferable. Admittedly, such a means of propulsion offers many and intricate basic-ballistic problems (on which, incidentally, the Americans have done much spade-work). Yet it is the simplest possible: the propellant (in the shape of "grains," i.e., extruded lengths of highly compressed colloidal double-base powder, usually tubular or cruciform in section) is located in the combustion space. On ignition it decomposes rapidly, producing hot gases at high pressure; these leave through the discharge nozzle or nozzles. There are no moving parts, but, at the same time, there is no regulation of the combustion or of the thrust during the burning period. With air-combat missiles, unrestricted burning is the rule, and the burning period is short (in the R.4/M it is 0.8 sec.); in few cases does it exceed two seconds. Hence, though combustion temperatures are of the order of 3,000 deg C, cooling is usually unnecessary in view of the short burning-time and the expendability of the missile. The propellant and the nozzle, which together form the "motor tube," take up considerable space; the missiles are, therefore, rather long and slim. This shape suits finned unrotated projectiles perfectly.

The propulsive jet not only provides thrust but also exerts influence upon stability, for a steady efflux may well damp out initial launching oscillations. In practice, the jet is usually far from steady, mostly on account of uneven burning and of the chemical and dynamic phenomena occuring whilst the hot gases are passing through the nozzle. Thus, small initial oscillations may even be aggravated, and this is the major cause of the flight-path deviations which are still characteristic of rocket missiles.

According to painstaking American research conducted on the obsolete M.8 unrotated supersonic rocket, the dispersion is about five times that of a good gun. The major dispersion arises during the burning; when combustion ceases, the missile behaves, ballistically, like a shell; and there is no basic difference in effect between spin-stabilization and stabilization by guide-fins.

The reasons for the high dispersion during burning are not yet clearly understood. The theory of propellant-combustion supposes that the combustion proceeds at a constant rate over the flame-exposed surface, and that equal layers of the fuel are transformed into gas at the same instant. As can be verified from any half-burned piece of celluloid (a near relative of the basic constituent) this is not completely true; moreover, the rate of burning varies during flight. The material is both heat- and pressure-sensitive, and the burning surface varies greatly during consumption. Consequently, gas is not produced at uniform rate. The theory, too, treats of orderly flow through nozzles; yet the behaviour of any water tap will suggest that this is a rather vague approximation. Therefore, between launching and exhaustion of the propellant, the mean thrust experiences an initial rise to a maximum and subsequent slow decrease, both accompanied by minor fluctuations; finally, it drops non-linearly to zero. There is much scope for research into these problems, the solution of which would make for substantial improvement of the ballistic properties of supersonic rocket missiles.

For air interception it is important that the emerging jet should be smokeless, and that, immediately after launching, the flame becomes as short as possible. Flash-suppressors can be incorporated in the propellant.

A possible way of decreasing dispersion might be to guide the missile mechanically (e.g., along launching rails) during combustion of the propellant. This, however, is not practicable; the R.4/M for instance, burns for a distance of 600ft. Should much higher initial accelerations be employed, however, mechanical guidance might be effective during the first instant of launching. This would then approximate the conditions obtained in a recoilless gun.

An important item of rocket design is the igniter, which has to heat the propellant to ignition temperature besides raising the initial pressure. Air combat demands instantaneous action; any lag renders the weapon useless. The "ignition delay" is, therefore, a vital factor; it ought to be about one five-hundredth of a second. That is quite practicable with electrically actuated squib igniters; a heated wire ignites a heat-sensitive explosive material—usually either some sort of granulated black powder, or a metal-powder mixture (magnesium or aluminium) with

potassium perchlorate, i.e., some sort of photographic flash-powder. The latter, however, is considered less dependable for quick and reliable action, because of deterioration when stored.

The electrical-squib igniter is preferably located at the foremost end of the grain, i.e., nearest to the warhead, so that the flame moves in a direction straight towards the discharge nozzle.

Against shock and rough treatment, rocket missiles are generally less sensitive than percussion-cap rounds of shell-guns.

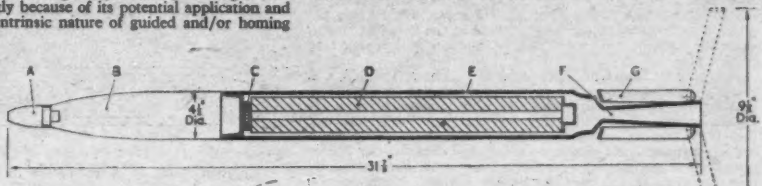
Guided Air-to-Air Rocket Missiles.—As mentioned previously, there is enthusiasm, both here and in the United States, for intercepters launching guided and homing missiles. The general idea is to employ these as one-shot weapons (as with the marine torpedo), and great advantages are expected in regard to combat range and to the possibility of launching attacks from other than ramming courses.

This policy of tactical development, however, is fraught with snares and pitfalls, partly because of its potential application and partly because of the intrinsic nature of guided and/or homing missiles.

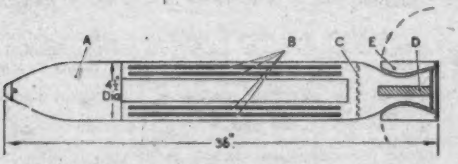
This is one of the snares of the "aerial-torpedo" interception policy. Suppose that waves of many small aircraft were to attack—what would be the use of a fleet of intercepters each equipped with one or two "torpedoes"? Such methods would savour of attacking a locust-swarm with a rifle.

A guided and/or homing missile must necessarily be large in comparison with a shell. It needs stabilizing and controlling devices, besides propulsion, regulation and the monitoring apparatus to serve guiding and homing. An intercepter could carry a few such weapons and, even then, stowage would present design-problems. Besides, such missiles are complicated and need most careful adjustment and handling. They are expensive, too, and make more claims upon the industrial war effort than do shells or plain rockets.

An application of naval-warfare methods to air interception also suffers from the basic difference that, at high altitude, the



(Above) Section through original (1944) German R.4/M rocket.



(Left) An interesting comparison is provided by the American M.8.

A = Warhead
B = Tubular ballistite propellant grains
C = Powder trap
D = Igniter with blow-out cover
E = Folding fins

We ought to beware of the notion that the atomic bomb as now known, or the hypothetical hydrogen bomb, will form the main weapon of air attack, i.e., that the enemy will base his major blows upon the use of a small number of rather substantial bombers or "flying bombs." First of all, there is evidence pointing to the existence, or possibility, of smaller atomic weapons that could be conveyed by twin-engined aircraft of medium size. Moreover, there are prospects that means might be contrived to frustrate weapons which rely on nuclear-fission processes. Hopes of such solutions may yet be faint indeed, but it is obvious that, were there a possibility of reducing the minimum critical size to an impracticably small value, by means of accelerated particles more powerful than stray neutrons, the "big bang" would have had it! This is, perhaps, one reason why Soviet Russia is so bent upon collecting atomic scientists from the Western Powers, and why the study of cosmic rays has become of so great importance for defence.

On the whole, it would seem unwise to base defence on the supposition that the attacker will rely on a comparatively small number of fairly large aircraft. A greater danger might, in fact, be presented not by a few "aerial battleships" but by a multitude of small, high performance craft.

intércepter cannot hide when stalking the target: there is no such thing as a "submarine of the air." The victim will, from the beginning, be aware of the intercepter and his intentions; he will have time and opportunity for defensive measures. Moreover, naval torpedoes cannot be traced by radar, but solely by less swift and/or accurate means, whilst the directed air-to-air missile (unless wire transmission is applied) can be effectively detected, interfered with and foiled, once the method of guidance or homing is determined. There are only a few physical principles of guiding and homing which are practical: all of them are well known and studied; none of them excludes *à priori* interference by an enemy, and/or appropriate protective methods.

In addition, guided missiles present inherent dangers for the attacker, particularly if, as will be the case, intercepter formations operate together. Robots are notoriously incapable of distinguishing between friend and foe; and their intricate mechanism easily goes wrong at the most inappropriate moment. No such danger arises from shells and simple rockets. Besides, the manoeuvrability of supersonic missiles is a moot point. The trajectorial radii are large; and this fact reflects adversely upon the possibilities of guiding the weapon to its target.

The guided air-to-air missile, however ingeniously designed,

COMPARATIVE DATA ON AIRBORNE ROCKET MISSILES

Type	Calibre (mm)	Stabilization Method	Length (in)	Weight at launching (lb)	Weight at impact (lb)	Propellant Weight (lb)	Propellant Material	Time of Burning (sec)	Velocity at End of Burning (ft/sec)	Explosive Charge (lb)	Remarks
Bordsprengrakete (1943)	210	Spin	49.5	248	206	41	7 tubular diglycol grains.	1.4	990	20.9	Ground weapon adapted for air combat; obsolete in 1944. Time fuse.
Bordschrapnelrakete R-100/85	210	Fixed fins ...	—	220	—	—	Multigrain ...	—	1,480	—	Carried 400 incendiary charges, type BR/44, of 2 oz. each.
R.4/M	55	Eight feeding fins.	31.9	7.75	5.85	1.9	Single tubular grain	0.8	1,000	1.1	Original version as operationally used in 1945. Impact fuse.
RZ.73 "Föhn" ...	73	—	—	—	—	—	—	0.333	510	—	Converted army missile; predecessor of R.4/M.
R.4/HI (Pb.III) ...	55	As R.4/M ...	—	8.85	6.95	1.9	As R.4/M ...	—	1,600	—	Shaped ("hollow") H.E. charge to rend armour.
M.8	114	Folding fins ...	36	35	30	5.0	Multigrain ballistite.	0.10	1,500	5.05	Obsolete.
H.V.A.R. (1945) ...	127	Fixed fins ...	72	140	115	24	Single cruciform grain ballistite.	—	1,380	7.25	Obsolescent
3.5in Anti-Sub. ...	89	Fixed fins ...	54.9	54	45.5	8.5	Single cruciform grain ballistite.	—	1,130	—	Obsolete; based on British U.P.3 design.
Mighty Mouse 2in ...	76	Folding fins ...	40 (appr.)	—	—	—	—	—	—	—	Design based on R.4/M, but with proximity fuze. Primary weapon for U.S. Navy fighters.

NOTE: The first five designs are of German origin; the remainder are American weapons.

FIGHTER ARMAMENT . . .

will most certainly not supersede shells or small independent rockets; it is even open to doubt if it at present constitutes a useful means of supplementing existing arrangements of intercepter armament.

Similar criticisms would seem to apply to the use of guided missiles as anti-aircraft defence from the ground. Although General Sir Frederick Pile, in his book *Ack-Ack*, states categorically: "We should once and for all write off the fighter as a means of defence," it would be wise to beware of similar sweeping statements, for the next two or three decades at least. For technical reasons alone, "push-button warfare" with controlled projectiles is still a long way off; for the present, the manned intercepter, *i.e.*, the flying gunner, must remain pre-eminent. Moreover, as the invader has now to be met long before he reaches this country, the distances and areas involved are too great to be covered by anything other than the human element, assisted by the best detection and destruction devices that may be available.

It is this human-element air defence which, as in 1940, will break the strong arm of the enemy. During the dark hours of greatest danger, early in June, 1940, Mr. Churchill wrote (to Field Marshal Smuts): "I see only one way through, to wit, that Hitler should attack this country, and in so doing break his air weapon." At that time the R.A.F. had but 25 fighter squadrons left, and with very little if any technical superiority over the German. It was the human element which decided the issue!

It would, therefore, be most unwise to place too much reliance on guided missiles as far as total air defence is concerned. Recent assurances given by Ministers of the Crown* should, hence, be viewed with caution. Also, responsible and well-informed American research workers have recently claimed publicly that the present state of Allied technique in guided missiles has not even reached the level the Germans had attained at the time of surrender.

Guided air-to-air missiles *might* permit defensive attack over fairly long ranges—five miles is a figure occasionally suggested; two miles is doubtless achievable, provided that the missiles are fast and manoeuvrable enough in the supersonic sense. They might thus compel enemy formations to break up. But the real question is whether formations of large enemy bombers are likely in future, and if any breaking-up of formations would be sufficient to frustrate their mission. Total air defence implies absolute destruction of the attacking force, and not merely a percentage of losses!

Possible Alternatives.—Guided missiles for air combat need not, of course, necessarily be rockets; ramjet propulsion, indeed, offers better prospects at the altitudes now operationally envisaged. Taking a longer view, there is reason to believe that the small supersonic air-combat rocket might well be superseded by a rocket-cum-ramjet combination.

Also, ramjet-propelled projectiles fired from low-velocity guns or mortars, and using a solid-fuel composition, may be completely practical for air-combat of the future. This might become the final solution of the problem of the large-bore, rapid-firing intercepter gun. There is no reason why drawbacks connected with dispersion cannot be overcome. In comparison with the rocket, a weapon having ramjet propulsion might even be preferable from this point of view, because stable combustion is more easily effected.

* *E.g. the announcement in the House of Commons made on March 21st, 1950, by the Secretary of State for Air.*

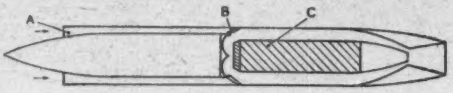
Conclusions.—The views put forward in this series of articles may, it is felt, be summed-up as follows:—

(1) Since the earliest days of air-fighting, armament development has always lagged behind. This state of affairs persists today.

(2) Intimate co-operation of the armament expert with the aircraft designer is a necessity: the armament and its characteristics define the design of a modern intercepter aircraft, which is basically nothing but a carrier of the chosen weapon or weapons and the gunner.

(3) There is cause for anxiety as to whether, in fighter-armament development, enough is being done to remedy the existing inferiority in equipment. In the event of a future major conflict, the use of inadequately armed fighter aircraft would prove disastrous for the nation.

(4) Certain promising German armament developments, which could have been had for the asking, have remained virtually disregarded, and for non-technical reasons.



A—Air entry B—Non-return flap valves C—Solid uel and initial propellant

Suggested design for a combination rocket-cum-ramjet missile.

(5) Shell-firing guns of substantially larger calibre than those hitherto installed in British aircraft may not be practical for intercepters; small, simple supersonic rocket or ramjet missiles, on the other hand, have promising possibilities.

(6) Automatic computing, ranging, and triggering are a necessity.

(7) To rely on guided missiles, in lieu of a multitude of aimed small projectiles launched in quick succession or simultaneously, will lead to grave disappointment.

(8) There is cause for an impartial enquiry into the position of intercepter armament, and into the policy guiding its future development. Greater emphasis should be laid upon research which relies on established facts and not on opinions or prejudices. Also, the methods employed to collect and to evaluate scientific intelligence may need overhaul.

(9) It is obvious that conventional methods of developing intercepter armament are inadequate so far as this country is concerned; much benefit could be derived from a close study of the former German efforts in this field. Unsponsored and unfettered air-armament development work ought to be encouraged and acknowledged, and special rewards and/or licence fees should be paid for successful work of this kind. In no circumstances and on no pretexts should armament research and design continue to be fettered, restricted or suppressed; it should, wherever possible, be promoted, even in cases where competition with Government establishments cannot be avoided.

(10) Those actually working on research or development in Government establishments should be given more freedom to solve the problems postulated by operational requirements; and the chiefs of such departments should not be reduced to the status of minor executives largely subordinated to Ministerial control. Scientists and engineers on Government work should be adequately paid, selected on the basis of competence and amply rewarded for successful achievements. The administration ought to encourage their initiative and resist attempts, from any quarter, to interfere with it.

THE WEB OF HISTORY

"The Royal Air Force in the World War," Volume IV, 1940-45. By Capt. Norman Macmillan. George G. Harrap and Co., Ltd., High Holborn, London, W.C.1. Illustrated. 15s.

IF you have read the three preceding volumes of Capt. Norman Macmillan's history of the R.A.F. in World War II it will not be necessary to recommend this fourth and last volume. Like them, it is crammed full of first-class stories, facts and figures covering every aspect of the R.A.F.'s achievements in Europe and the Far East from 1940 to 1945. If you have *not* read the earlier volumes, that is no reason why you should not buy this one, for it is completely self-contained and in many respects the most interesting of the series.

Here one can read again of the epic highlights of the air war —Guy Gibson's dam-busting raid, the *Bismarck* episode, Arnhem, the arrival of Rudolf Hess, defence against the flying bombs, and so on. But modern campaigns are seldom won by a few outstanding actions, and Capt. Macmillan has ably portrayed the slow, grim war of attrition which made up the other side of the picture. He tells of gallant exploits that earned 32 V.C.s for R.A.F. officers and airmen; but he also recalls the day-to-day, dull, monotonous duties of the humble "erks," nursing services and Royal Observer Corps; the endless but vital sea patrols carried out by Coastal Command; behind-the-scenes research by Intelligence teams and "back-room boys." All these formed essential contributions to victory.

Nor is this a mere chronological catalogue of stories, for Capt. Macmillan has attempted to analyse both successes and defeats impartially and objectively. He shows, for example, how the root cause of British defeat in Malaya by the Japs arose from policy decisions made in 1927, and how failure of the Arnhem operation allowed the Russians to reach Berlin first and thus sowed the seeds of post-war problems. He explains why we could not sink the *Scharnhorst* and *Gneisenau* at Brest, and how they were able to slip through the Channel to safety. Such analysis is more valuable than the mere recording of history, for, provided that past errors are frankly faced, their lessons heeded and applied, they can be more valuable for the future than many successes.

J. W. R. T.

WEIGHT-LIFTER: Although designed primarily as a military transport, the Nord 2501—seen during its official presentation at Toussus-le-Noble last week—has a distinct civil application; its large, rearward facing clam-shell doors provide easy access for vehicles and bulky loads. Powered by two Hercules 793s, the 2501 has a payload of 6 metric tons and can cruise at 280 m.p.h.

CIVIL AVIATION NEWS

I.C.A.O. OVERSEAS

THE activities of I.C.A.O.'s Regional Offices in the Far East and Pacific areas have recently included an important mission to Indonesia where, in spite of difficulties arising from the complicated internal situation, essential civil-aviation services have continued to function. I.C.A.O.'s representative reports that the new Indonesian Government has now assumed complete control of all civil aviation and has laid down a programme for the maintenance and improvement of airfields; this includes the construction of a new 7,500ft runway at Kamajoran, Djakarta. Traffic-control facilities have been re-established, as has the urgently needed Djakarta sub-area meteorological broadcast service. There is reported to be a shortage of trained meteorological personnel, however. I.C.A.O. is also helping to establish a search and rescue organization.

I.C.A.O.'s Far East office (which is at Melbourne) reports that visits such as that to Indonesia have been followed by a marked improvement in relations with member States and by a greater exchange of information.

Other activities of the Melbourne office have included an informal meeting between government and airline representatives to discuss the introduction of long-range radio-telephony for air-to-ground communications in the south Pacific. A series of progress reports has also been issued, showing the state of implementation of the various recommendations made by the last South East Asia Regional Air Navigation Meeting.

In another part of the world, I.C.A.O.'s South American representative has visited Colombia, Venezuela and Equador. In the first-named country there is reported to be an active Directorate of Civil Aviation which is now planning to expand the already extensive network of internal routes. The I.C.A.O. representative found that, in spite of a shortage of trained personnel, the recommendations of the South American Regional Air Navigation Meeting have been largely implemented and a number of meteorological stations, planned by the Second Caribbean Regional Conference, are to be set up in the near future. It is interesting to note that Avianca, the Colombian State airline, has now become one of the world's largest freight carriers.

In Venezuela, the Department of Civil Aviation was found to be giving high priority to the implementation of I.C.A.O. standards and procedures. These include the establishment of a comprehensive communications network, the provision of radio aids throughout the country, and the siting of an additional 40 met. reporting stations.

In Equador—at present a non-contracting State—I.C.A.O. also found that its recommendations have been given effect to a far greater extent than had been expected.

The organization's other regional offices have also been very active and the European and African Office, based at Paris, has now begun preparations for the third Eumed Region Air Navigation Meeting, to be held in June. The meeting will be presented with a complete report on the air routes and facilities in this area.

UNEXPECTED SOLUTION

THE application of "Moral Rearmament" principles is claimed by Mr. W. A. Patterson, president of United Air Lines, to have averted a national airline strike which would have cost about $12,000,000. Speaking before the National Assembly for Moral Rearmament in Washington recently, Mr. Patterson reported that negotiations deadlocked for 16 months had been resumed "in a new spirit." Some 119 demands were quickly reduced to eleven problems, eight of which were subsequently settled in ten days; on the three remaining questions an understanding was obtained of how the basic differences could be resolved. In fact, United's president now considers that such a spirit exists to-day between his company's management and workers that "no problems can arise which cannot be solved by these methods."

Having heard the case of United Airlines and the views of Mr. Patterson, the head of National Airlines flew from Florida to Washington with members of his management committee and labour representatives, and subsequently it was stated by Mr. W. T. Babbitt, vice-president of the Air Line Pilots' Association in America, that "through the joint effort based on the ideology and spirit of Moral Rearmament," the pending strike of National Airlines pilots had been averted. At this same time members of a M.R.A. delegation from Europe were reporting to the Armed Services Committee of the U.S. Senate on the contribution M.R.A. was making to the unity of the West.

B.E.A.-SWISSAIR AGREEMENT

BY mutual agreement, B.E.A. and Swissair have ended the arrangement under which they acted as agents for each other in the two countries. B.E.A. has established its own organization with offices at Zurich and Geneva, while Swissair has opened a general office in London, with branches in Manchester and Glasgow. Freight traffic, however, will continue to be handled as under the previous arrangement.

B.E.A. will also act as passenger agents in Switzerland for B.O.A.C., Q.E.A. and Cyprus Airways.

PASSENGER-BAIT

ONE of the latest B.O.A.C. moves to capture a major share of the American tourist traffic on North Atlantic routes this year is seen in the plan to inaugurate new de luxe "Monarch" flights between London and New York. They will be introduced on March 1st. Initial frequency will be three times weekly in both directions, increasing to five times weekly from April 1st and daily from May 1st.

Attractions to be offered to passengers without extra charge include a seven-course dinner with free cocktails and champagne, breakfast in bed, "beauty kits" for women passengers and overnight bags for all travellers.

By such means the Corporation hopes to book a large num-

CIVIL AVIATION NEWS . . .

ber of American visitors to Britain who might otherwise be attracted by the extravagantly luxurious facilities already provided by American operators. Indeed, it now seems that we are approaching the stage when the prospective transatlantic passenger will only be able to solve the problem of which company to patronize by making a careful study of their respective wine-lists.

AMERICAN AIR-SAFETY

AN article by Mr. T. P. Wright, of Cornell University entitled *Research and Development to Promote Safety in Aviation*, provides some interesting statistical data on the improvement in air safety in the United States during the past few years.

Mr. Wright points out that, in the four five-year periods from 1930, American domestic scheduled operators have shown a record of, respectively, 15, 6.1, 2.4 and 1.8 passenger fatalities per 100,000,000 passenger miles. Last year's figure was 1.3. The safety-record for sea-crossing services, which in 1949 was perfect, is said to be even better than that of surface vessels.

The evidence, says the author, shows that transport by domestic airlines is safer than private-car travel in America by a factor of more than two; bus or rail transport, however, remains safer by a factor of about six.

The safety-record for non-scheduled flying is apparently not quite so encouraging, for, as Mr. Wright says, the very nature of this type of operation creates conditions favourable to accidents.

So far as private flying is concerned, the record of pilots is unsatisfactory; it appears, in fact, that such flying in the United States is less than one-thirteenth as safe as travelling with a scheduled carrier. Last year's accidents involving private aircraft resulted in one fatal acident for every 80 certified machines in the country, while every 2,000,000 aircraft-miles flown saw at least one fatality.

The article indicates that almost 40 per cent of the accidents involving private aircraft occur during normal operations, including landings, take-offs and taxying, while only a very small percentage of incidents in this category is found in scheduled-carrier flying. Fifteen per cent of all personal-flying accidents have been found to be due to stalling, frequently from turns, and 45 per cent of the fatalities were caused by incidents of this nature. Forced landings caused 20 per cent of the private-flying accidents, and collisions with obstacles 15 per cent. The remaining 10 per cent were listed under the heading of "all other causes."

Mr. Wright considers that his analysis shows the need for a considerable all-round improvement "either in pilot ability or in the aircraft themselves to permit safe flying by inexpert pilots." It is estimated that 90 per cent of the fatal accidents and 75 per cent of all accidents can be attributed to pilot error. Of these, 40 per cent are caused by careless or reckless flying. Although the statistics show that structural and power-plant failures are infrequent, their results are usually so serious that continuing improvement is called for.

The problem of weather, although now approaching solution so far as the operations of scheduled carriers are concerned, is still said to be a primary influence on private-flying safety.

BRITISH FLIGHTS TO CHINA

HONG KONG AIRWAYS are now reported to have abandoned their plans to fly services into Communist China. The airline, which is owned by Jardine, Matheson and Company, Ltd., the largest and oldest British commercial firm in the Far East, had applied for a licence to operate to Shanghai, Tientsin, Chungking and Canton when formal recognition of the Communist government was first made by Britain last year. The plans were suspended when the Communists failed to exchange envoys. All but two of the company's aircrews, most of whom were transferred from B.O.A.C. have now been released. The two remaining crews have been retained to operate services to Formosa and Japan.

British Airways' Operations Statistics for August, 1950

(Figures for the corresponding period in 1949 are given in parentheses)

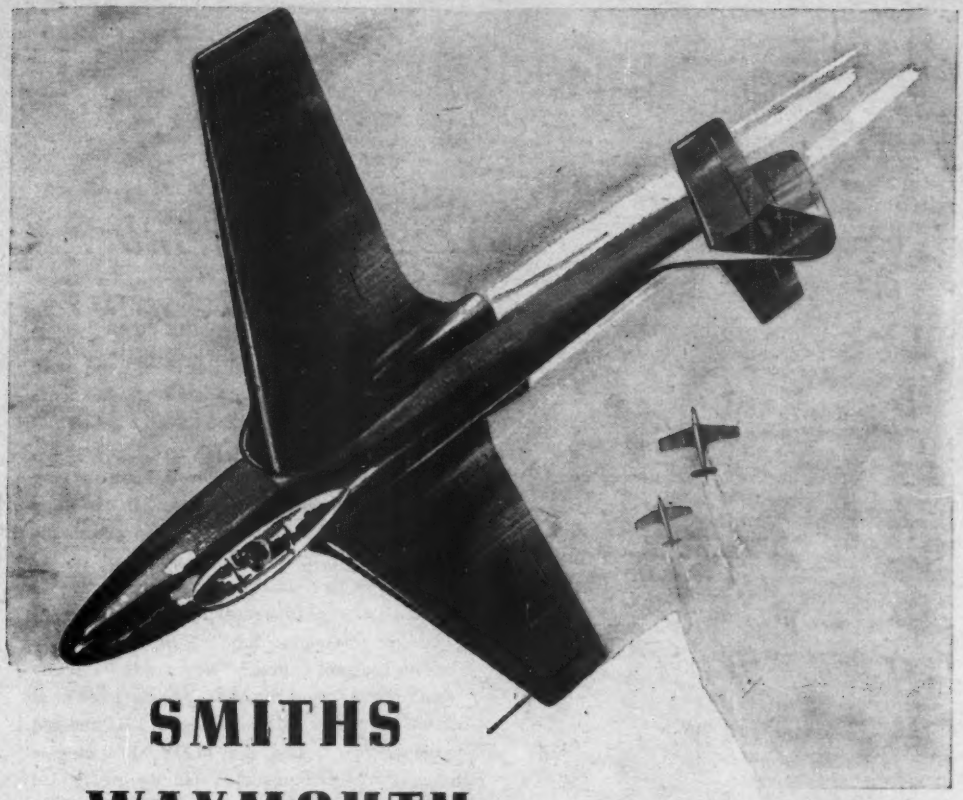
	B.O.A.C. All Areas	B.O.A.C. Western Area	B.O.A.C. Eastern Area	B.O.A.C. South American Area	B.E.A. All Divisions	B.E.A. British Division	B.E.A. Continental Division
Total revenue aircraft-miles ...	2,461,259 (2,440,565)	406,450 (347,642)	1,425,734 (1,658,714)	536,616 (348,619)	2,310,512 (1,721,703)	836,654 (632,106)	1,473,858 (1,089,599)
Total aircraft-miles	2,775,488 (2,845,159)	411,392 (366,398)	1,458,134 (1,689,714)	549,274 (368,527)	2,350,926 (1,756,212)	845,869 (647,427)	1,495,080 (1,108,785)
Revenue passengers carried ...	17,016 (13,054)	4,400 (3,434)	8,920 (8,307)	3,696 (1,313)	130,212 (103,717)	73,539 (64,081)	56,673 (39,636)
Revenue passenger-miles	50,844,845 (35,470,451)	13,750,794 (8,109,144)	30,575,561 (25,244,212)	6,518,490 (2,117,095)	33,649,301 (27,048,256)	12,390,702 (10,481,892)	21,258,599 (16,566,364)
Available seat-miles	90,005,919 (57,364,230)	25,637,599 (11,353,321)	45,528,586 (39,737,275)	18,839,734 (6,273,634)	51,369,567 (37,991,077)	18,707,866 (13,579,591)	32,661,701 (24,411,486)
Revenue passenger load-factor (per cent)	56.5 (61.8)	53.6 (71.4)	67.2 (63.5)	34.6 (33.7)	65.5 (71.2)	66.2 (77.2)	65.1 (67.9)
Cargo carried (tons):							
Mail	146.5 (139.5)	27.8 (29.2)	100.3 (96.4)	18.4 (13.9)	370.7 (287.3)	119.6 (106.3)	259.1 (181.0)
Freight	434.8 (309.7)	62.5 (40.2)	311.3 (238.7)	61.0 (31.2)	850.0 (541.5)	233.6 (183.5)	616.4 (358.0)
Total revenue load ton-miles ...	7,323,083 (5,168,421)	1,396,144 (982,924)	4,820,189 (3,807,170)	906,750 (378,327)	3,324,485 (2,591,156)	1,021,952 (865,109)	2,302,533 (1,726,047)
Total usable capacity ton-miles ...	12,581,175 (9,948,763)	2,821,658 (1,699,066)	6,957,940 (6,613,385)	2,503,392 (1,298,602)	5,408,127 (4,046,472)	1,717,864 (1,248,966)	3,690,263 (2,797,506)
Overall revenue load-factor (per cent)	59.6 (53.8)	56.6 (57.9)	69.3 (57.6)	36.2 (29.1)	59.8 (64.6)	59.8 (70.7)	59.8 (61.9)
Total revenue hours...	11,212 (12,491)	1,625 (1,546)	6,759 (8,526)	2,424 (1,794)	15,646 (11,714)	6,831 (5,227)	8,815 (6,487)
Total non-revenue hours	1,727 (2,412)	31 (96)	196 (178)	66 (113)	290 (272)	86 (140)	138 (132)
Equivalent annual utilization (revenue hours) per aircraft ...	1,761 (1,381)	— —	— —	— —	1,854 (1,497)	1,599 (1,375)	2,114 (1,614)
Unduplicated route miles in operation at end of period	69,965 (79,925)	6,911 (7,700)	46,261 (52,493)	16,793 (19,732)	13,349 (13,683)	3,370 (2,569)	9,979 (11,134)
Percentage regularity	99.1 (99.2)	100.0 (94.6)	98.9 (99.9)	99.1 (100.0)	98.1 (98.2)	97.8 (98.1)	98.7 (98.2)
Average length of stage flight (miles)	1,079 (1,026)	1,416 (1,107)	1,057 (1,028)	960 (945)	203 (198)	119 (114)	357 (355)

IN August the two British airways corporations, together with charter companies operating under associate agreements with B.E.A., carried 21 per cent more passengers, 22 per cent more freight and 23 per cent more mail than in the corresponding month of 1949. The figures for passenger-miles, freight ton-miles and mail ton-miles increased by 34, 50 and 14 per cent respectively.

These improvements were achieved as the result of a 29 per cent increase in usable capacity ton-miles, while the overall revenue load-factor rose from 51 per cent in August, 1949, to nearly 60 per cent in August, 1950.

The total number of passengers carried during the month was 162,000, of which B.O.A.C. accounted for 17,000 and B.E.A. for 130,000; the passenger-mileage figures for the two Corporations were 50,000,000 and 33,000,000 respectively. Of B.E.A.'s total, over 21,000,000 passenger-miles were flown on Continental routes alone. B.E.A.'s associates, incidentally, accounted for nearly 2,000,000 passenger-miles.

The figures for freight and mail lifted by both airlines and B.E.A.'s associates were 3,118 tons and 526 tons respectively. The principal traffic statistics for the two Corporations, as recently issued, are show in the table above.



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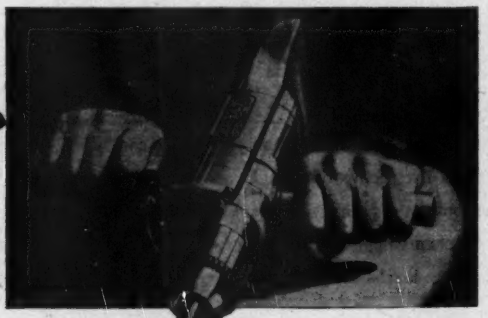

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CIVIL AVIATION NEWS

BREVITIES

A B.O.A.C. Hermes flew last week from London Airport to Tripoli in 4 hr 51 min; its average speed was 313 m.p.h. Normal scheduled time for the run is 7½ hr.

* * *

The Australian Airline pilots' Association is now seeking British pilots "for immediate employment." It has also been announced that a training school for civil pilots will soon be opened. The average age of captains and first officers at the moment is said to be between 28 and 32 and there is a serious shortage of new men. Companies are already looking to the flying clubs as a possible source of supply of second pilots.

* * *

Under the terms of an agreement between Italian civil aviation authorities and International Aeradio, Ltd., two traffic control advisers are being sent to the airports at Ciampino (Rome) and Malpensa (Milan). I.A.L. now has a large number of overseas commitments throughout the world, but this is considered to be the company's most important assignment in Europe to date. It is thought likely that it may also be the forerunner of similar arrangements with other governments.

* * *

B.E.A. has announced provisional arrangements for reciprocal night services to carry newspapers between London, Glasgow and Manchester. They will probably begin on June 1st and, although no figure has yet been quoted, passengers will also be carried at fares representing "considerable reductions" on the normal London-Glasgow rate of £11 return. Aircraft will leave Renfrew at 11 p.m., reaching Manchester at 12.30 a.m. and Northolt at 2.30 a.m. The North-bound aircraft will leave London at 1 a.m.

Compared with the previous year, traffic at Bromma, the airport for Stockholm, showed a heavy increase during 1950. There was a particularly sharp rise (70 per cent) in the amount of freight handled; this totalled 3,370 tons as compared with 2,248 in 1949.

* * *

Canada is soon to have its first direct air link with Europe. T.C.A. will inaugurate a service from Montreal to Paris, using North Stars, on April 1st; this follows the conclusion of a bilateral air agreement between the two governments last August. Initial frequency will be one flight weekly, increasing to twice weekly during the summer. Flight time for the 3,500-mile journey between Montreal and Orly will be 15 hr.

* * *

As a result of the recent appeal to pilots for information on reported instances of interference to V.H.F. broadcasts in this country, the M.C.A. has now been able to trace the cause of the trouble to a harmonic transmission of a B.B.C. short-wave overseas frequency. The M.C.A. now wishes to thank all pilots who have sent in reports, but asks also that, in order to determine the adequacy of the remedial measures taken, aircrews will continue to report for a further short period.

* * *

On January 16th, the Minister of Civil Aviation, Lord Pakenham, visited Prestwick and Renfrew airports and was later entertained by the Scottish Advisory Council on Civil Aviation. It is understood that his visit was to discuss the Clydesmuir Committee's report on the future of Prestwick and to study the layout at the airfield itself. The present expansion scheme for Prestwick includes the construction of a new runway and terminal buildings at a cost of £5,000,000. Work is not due to begin before 1953.

GLIDING NEWS

BUILT-IN THERMALS: A French glider fitted with four pulsejet units recently made an experimental flight at Melun Villaroche airfield near Paris. Each pulsejet weighs about 10 lb and with their aid the machine is able to make a normal take-off. The glider is an Emouchet, and the Escopette power units were developed by S.N.E.C.M.A. Thrust per unit is 22 lb.

THE 1951 British National Gliding Championships will again be run by the Derbyshire and Lancashire Gliding Club, at Camphill. Tentative dates are July 22nd to 29th, inclusive. The Kemsley Trophy—a silver Warwick Vase formally presented to the B.G.A. by Lord Kemsley at his cocktail party on the occasion of B.G.A.'s 21st anniversary—will be awarded annually to the champion club team at the conclusion of the National Championships.

In the past, selectors of the British team for participation in the International Gliding Contests have been handicapped by the difficulty of judging individual ability owing to the rarity of the occasions upon which they fly competitively. The National Championships afford little or no guide to selection to the Internationals, as the former are often held after the Internationals have taken place. In any case, it does not necessarily follow that the winners of the Nationals would be available to take part in the Internationals, or that all those suitable for the Internationals would be able to show their prowess at the Nationals. The B.G.A. selectors were, therefore, forced to adopt an arbitrary standard, which in 1950 was the possession of a Gold Badge. This excluded some pilots with consistently good records, such as Mr. Stephenson, of the London Club, who, for personal reasons, has been unable to obtain his Gold Badge.

To overcome such difficulties, the B.G.A. has now initiated a scheme of "task-flying matches," full details of which may be obtained from the Association. The scheme allows a match to take place wherever and whenever there are two or more pilots available at the same time and place to undertake the same task. With a handicap system similar to that used in the 1950 Nationals, a direct comparison will be afforded between the performances of the two or more pilots competing in the match.

The arrangements, which are extremely flexible, are left in the hands of clubs themselves. A pilot will have to complete a sufficient number of matches during the year to show his worthiness of consideration for selection to a place in the International Team. Stated tasks include goal, out-and-return and 100-km races and up-wind distance matches, all of which should provide really competitive conditions under which individual ability may be assessed and noted by the B.G.A.

* * *

The B.G.A. annual general meeting is to be held at Londonderry House, Park Lane, London, at 2.30 p.m., on Saturday, March 17th. Retiring members of the council, eligible for re-election, include Mrs. Ann Douglas, of the Surrey Club and Mr. B. Meads, M.B.E., of the Derby and Lancs Club.

* * *

The list of flights for consideration for 1950 annual awards closed on January 16th. It seems likely that the following performances may score: Height, 21,340 feet; goal, 134 miles; distance, 200 miles approx.; out-and-return, 141 miles; two-seater goal, 85 miles (Kranich), 75 miles (T.21). M. E. P.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Wanted—P.R. Canberras

MY satisfaction on learning that, before many months have passed, R.A.F. bomber squadrons will be armed with English Electric Canberras is tinged with concern. These machines will be equipped for tactical bombing and not, as to me seems logical, for strategic reconnaissance.

If the late war proved anything at all, it was that photographic reconnaissance is a vastly important medium of operational and technical intelligence, and the aircraft employed must obviously be of the very highest quality. Surely none was ever a more obvious "natural" for high-altitude, long-range flying than the Canberra, and the sooner some of these astonishing machines are given a "P.R." designation, the easier I, for one, shall feel.

Something must be amiss when war-time Spitfires and Mosquitoes remain, in the year 1951, the standard R.A.F. equipment for strategic reconnaissance. Excellent a machine as the new Meteor P.R.10 undoubtedly is, its range can hardly compare with the Canberra's. Ex-P.R.U.

Beccles, Suffolk.

The World's DC-3s

YOUR statement that a total of 505 DC-3s are to-day engaged in commercial operation throughout the world ("Civil Aviation News," page 36, January 11th) does not appear to check with recent official statements put out by the statistics division of the C.A.B., and also that of the director of public relations of the Douglas Aircraft Company Inc.

According to the C.A.B. there are 1,093 DC-3s in airline service outside the U.S.A., whilst in America the domestic and charter companies (plus a small number of private owners) operate a total of about 1,500 of this type.

An official release by the Douglas Company puts the world total of DC-3s as about 5,275—this, of course, includes the military C-47 versions, but excludes those still operated by the Soviet Union. It will be remembered that some 700 C-47s were supplied to Russia under wartime Lend-Lease. The Douglas release states 1,200 C-47s are still in U.S.A.F. service, plus a further 200 in the U.S. Navy. They estimate that about half the 3,000 DC-3s operated by countries excluding the U.S. are used by the various air forces of practically every country in the world.

It is interesting to note that the biggest airline fleet of DC-3s is owned by Trans World Airlines—they have 70 still in service on their domestic network throughout America. It seems a big percentage of this fleet will be in service for another year or two, perhaps longer. D. M. P.

Prestwick, Ayrshire.

[The figure of 505, from an American source which we believe to be reliable, referred to DC-3s (not C-47s or converted military variants) on scheduled services with regular airlines, i.e., not including charter operators. It excludes DC-3s in use in Russia, about which no information is obtainable.—ED.]

Navaids in War-time

I READ with great interest and no little appreciation the excellent article on navigational aids in the January 11th issue of *Flight*. If the advantages of the Decca Navigator system are indeed as outstanding as Mr. Bailey-Watson points out (and I have no reason to believe that his facts are wrong) it is difficult to understand why there is any hesitation about adopting Decca as *the* aid. Apparently the alternative, V.O.R./D.M.E. (or O.B.D.) has an inferior performance to Decca if one may judge by the results of the evaluation trials mentioned separately in the same issue.

It occurs to me that one of the drawbacks of Decca is that, in war, the enemy could home on the signals—could, in fact, use the system as a navaid to reach selected targets. But on the other hand, this is probably an inherent quality of any navaid system employing ground stations, although the problem might be somewhat easier for the enemy to solve in the case of Decca.

No one, to my knowledge, has ever come out into the open and stated that a particular system considered for civil use is unsuitable because it would have military drawbacks. If there was in existence a navaid system which fulfilled all the requirements of accuracy and, whilst ostensibly a civil aid, had no military disadvantages, I should unhesitatingly vote in favour of it, but I have never heard that such a panacean system exists, even on paper.

Let the European nations—who have shown a willingness to get together on the most vital issues of all—get together on this vital issue of navaids. And as Britain has had to give a lead in other directions, let it give a lead in this one also.

London, S.W.10. CLAUDE ALDBURY.

Why So Few?

ONE of the "3,300 British private pilots" who, in the Correspondence columns of your January 18th issue, considers that Britain is lacking in air-mindedness, should surely seek elsewhere the reason for our unassuming position in the "private-flying enthusiasm" table.

I should have thought that this country's ability to produce a military force with such a noble record as that of the R.A.F., was in itself "proof of the pudding." As for British civil aviation—well, ask any much-travelled passenger why he remains a staunch patron of British companies, even in the face of such bribes, from foreign competitors, as a gourmet's cuisine, an exquisite wine list and a souvenir bar of soap.

I believe, also, that the safety record of our flying clubs is infinitely better than those of several more "air-minded" nations. The fact that these clubs are less numerous or less frequented is, to my mind, certainly not due to the absence of an air-minded outlook, but to sheer lack of opportunity. If our worthy Government, having awakened—or having been awakened—to the necessity of fostering (instead of hampering) the now-dormant interest in flying, would encourage the movement on a large scale, I am sure that "one of the 3,300" would quickly find himself "one of the 33,000."

London, N.W.3. ANOTHER OF THE 3,300.

Festival Railplane?

QUITE recently I paid a visit to Glasgow and was surprised to see that the original "Benny Railplane" is still in place. Would this not have been an ideal type of machine to have had in operation during the Festival of Britain—say between Marble Arch and the South Bank? For those who are unfamiliar with this invention I should explain that it consists very simply of an elevated railway on which runs a streamlined carriage propelled at high speed by diesel engines driving propellers at each end. The carriage has wheels running on single rails at top and bottom.

Would not this same machine, powered by two of Britain's most powerful jets, have been a tremendous attraction as well as an ideal method of transport for the exhibition?

Shepperton, Middlesex. R. RUSSELL.

FORTHCOMING EVENTS

Jan. 25. R.Ae.S. (Isle of Wight): "Economic Aspects of Civil Aviation," by Peter G. Masefield, M.A. (Eng.), F.R.Ae.S., A.F.Inst.A.E., G.Inst.Mech.E., M.Inst.T.

Jan. 25. R.Ae.S. (Manchester): "The Viscount," by G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.

Jan. 26. R.Ae.S. (Birmingham): "Flying the Brabazon," by A. J. Pegg, O.B.E.

Jan. 27. Society of Licensed Aircraft Engineers: "Rocket Propulsion and Interplanetary Flight," by John Humphries, B.Sc. (Eng.), A.M.I.Mech.E., A.F.R.Ae.S.

Jan. 30. Society of Instrument Technology: "Machining of Small Instrument Parts," by K. J. B. Wolfe and P. Spear.

Jan. 30. R.Ae.S. Section Lecture: "Cabin Superchargers and Cooling Equipment for Civil Aircraft," by W. D. L. Theed.

Jan. 30. R.Ae.S. (Bristol): "Aerodynamic Oscillation of Suspension Bridges," by R. A. Frazer, D.Sc., F.R.Ae.S., F.I.Ae.S.

Jan. 31. R.Ae.S. (Weybridge): "S. F. Cody," by G. A. Broomfield.

Jan. 31. Royal United Service Institution: "Campaigning in Korea."—Film and Commentary by William Courtenay, O.B.E., M.M.

Jan. 31. R.A.F. College Cranwell: Cross-country and Boxing v. R.M.A. Sandhurst (away).

Feb. 1. British Institution of Radio Engineers (Scottish Section): "Multi-station V.H.F. Systems using Frequency Modulation," by W. P. Cole, B.Sc. and E. G. Hamer, B.Sc., A.M.Brit. I.R.E.

Feb. 1. R.Ae.S. (Portsmouth): Film: "Stainless Steels."

Feb. 2. R.Ae.S. (Glos. and Cheltenham): "Gliding," by P. A. Wills, C.B.E.

Feb. 3. British Interplanetary Society: "Interplanetary Orbits," by Dr. J. G. Porter, Ph.D., F.R.A.S.

Feb. 5. R.Ae.S. (Derby): "Pressurizing and Air-Conditioning," by W. M. Widgery, F.R.Ae.S.

Feb. 5. R.Ae.S. (Halton): "Aerodynamics Division of the N.P.L.," by A. Fage, F.R.S., F.I.Ae.S., F.R.Ae.S.

Feb. 6. R.Ae.C.: Colour Film of Korean Campaign, by William Courtenay, O.B.E., M.M.

Feb. 7. R.Ae.S. (Luton): "Interplanetary Travel," by A. Clark, B.Sc.

Feb. 7. Royal United Service Institution: "Flying-boats in War," by A. V-M. P. H. Mackworth, C.B., C.B.E., D.F.C.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

REINFORCEMENTS: A scene aboard H.M.S "Unicorn," replenishment carrier for the Far Eastern Fleet. The Sea Fury and Firefly shown are destined for the 17th C.A.G. (H.M.S. "Theseus"), which has won the Boyd Trophy for its recent achievements in Korean waters.

17th C.A.G. Win Boyd Trophy

RECENT operations by the 17th Carrier Air Group in H.M.S. *Theseus* off Korea have won for the Group the Boyd Trophy for 1950. The Trophy—a silver model of a Swordfish—is awarded annually for the "finest feat of aviation" by an individual or unit of the Royal Navy. It has never before been won by an entire carrier air group.

The Group's Fireflies and Sea Furies have recently been flying 60 sorties a day. The Commander, Lt. Cdr. M. P. Gordon Smith, D.S.C., said last week that 301 sorties had been flown in the Group's latest operation, which featured much closer co-operation with the Army ashore, particularly with the U.S. 25th Division and the British 29th Brigade.

Lt. W. Noble recently made the Group's 2,500th landing since the *Theseus* left the United Kingdom last August, and on the same day the ship's only Marine pilot, Lt. R. Hignett, made the 1,000th consecutive accident-free landing for the 17th C.A.G.

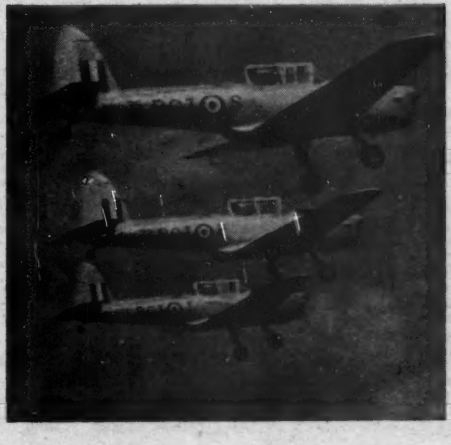
Working under difficult conditions, maintenance crews have set up an enviable record: during the whole period off Korea no aircraft has been unserviceable for more than two hours. Aircraft from the *Theseus* have, it is estimated, fired 150,000 rounds of 20mm. ammunition, fired 2,123 rockets and dropped 304 500lb bombs. The hard-pressed ordnance staffs, who have made 365 gun-changes, have been assisted by men of the Royal Marine Band.

Anglo-Iraqi

TWO R.A.F. squadrons—one of Vampires and one of Brigands—recently completed a four-week training programme at Habbaniyah in conjunction with a Fury squadron of the Royal Iraqi Air Force. The climax of the Iraqi visit was a display of gunnery, rocket-firing, bombing and aerobatics at Makyab ranges, attended by King Feisal and the A.O.C. Iraq, A.V-M. G. R. Beamish.

National Service News

NEW concessions for prospective National Service aircrew are announced by the Air Ministry. Young men holding School Certificate or its equivalent may attend the Combined Selection Centre for aptitude tests at the age of 17, instead of 18. If successful, they will be given a certificate enabling them to begin training at 17½—and thus complete their two-year period of National Service six months earlier—or, if they wish, wait until the normal call-up age of 18.



THREE'S COMPANY: Neat formation work by three Chipmunks of No. 18 R.F.S., based at Fairoaks. Re-equipment of the R.A.F.V.R. with the popular Chipmunk is proceeding well: the new trainers now outnumber their Tiger Moth ancestors in V.R. service.

One member of the R.A.F. in every three is a National Serviceman, and over 1,000 of them hold commissions. All N.S. pilots and navigators are now granted commissions in the G.D. Branch.

New Pakistan C.-in-C.

HIS Majesty's Government has placed at the disposal of the Government of Pakistan the services of A. Cdre. Leslie William Cannon, C.B.E., R.A.F., for appointment as Commander-in-Chief of the Royal Pakistan Air Force in succession to A.V.-M. R. L. R. Atcherley, C.B.E., A.F.C., who has held the post since February, 1949. A. Cdre. Cannon will assume the appointment, with the acting rank of Air Vice-Marshal, in April.

The new C.-in-C., who is 46, entered the R.A.F. in 1920 as an apprentice. He was awarded a Cranwell cadetship and was commissioned in 1925. After a period of flying service—on army co-operation duties in China and as an instructor at home—he took a two-year engineering course at the Home Aircraft Depot, Henlow. From 1933-37 he served in India, first on engineering duties at Air H.Q., later with Nos. 60 and 5 Squadrons.

During the war, A. Cdre. Cannon served with Bomber Command on the engineering staff at H.Q. and in command of several stations in No. 2 Group. He was also, from 1941-42, an instructor at the R.A.F. Staff College. After the war he commanded No. 85 Group, B.A.F.O. for six months before taking the 1947 course at the Imperial Defence College. From January, 1948, until November, 1949, he was at the R.A.F. Staff College, Andover, first as assistant commandant and later as commandant. Until recently he has been Director of Organization (Establishments) at the Air Ministry.

Red Indians at Odiham

THE advance guard of No. 421 (Red Indian) Squadron, R.C.A.F., arrived at Odiham on January 18th in a Canadair North Star. The Commanding Officer, S/L R. T. P. Davidson, D.F.C., led the party of four officers and 16 airmen, who were flown from their base at Chatham, New Brunswick, *via* Goose Bay and Reykjavik. Further detachments are on their way, and the entire Squadron is expected to be ready to begin training by January 28th.

For the next 12 months, 421 Squadron

SERVICE AVIATION...

will be under the operational control of Fighter Command and will undertake joint training with R.A.F. fighter squadrons. Its own Vampire 3s remain in Canada; the R.A.F. will provide the Squadron with Vampire 5 fighter-bombers (and Meteor 7s for dual instruction) during its stay.

The Red Indian Squadron (so named after its unit badge) was originally formed in Britain—at Digby—in April, 1942. For the ensuing three years it operated with Fighter Command and—during the liberation of Europe and invasion of Germany—Second T.A.F. Disbanded after the war, "421" was re-formed with Vampires in 1949. Odiham, incidentally, was the first base of the first R.C.A.F. unit to arrive in Britain during the war—No. 400 (City of Toronto) Squadron.

R.C.A.F. Lancasters

THE first of a number of Canadian-built Avro Lancasters, reconditioned for maritime-reconnaissance duties, was flown recently from Malton Airport to Greenwood, Nova Scotia, for active service. Numbered 919, it was one of the batch built during the war by Victory Aircraft, predecessor of Avro Canada. Both Avro Canada and de Havilland Aircraft are now engaged on Lancaster conversions for various operational purposes.

R.A.F. Sailing Association

THE 1951 plans of the R.A.F. Sailing Association include the formation of an ocean cruising section, the appointment of Rear Commodores for the cruising and dinghies sections, and the formation of a committee to supervise conversion of the association's airborne lifeboats. Plans are already in hand for a regatta and for participation in the R.A.F. Inter-Command Ocean Race.

There are now 40 clubs and nearly a thousand members in the R.A.F. Sailing Association, whose fleet has been augmented by 76 airborne lifeboats purchased from the Air Ministry with the aid of a grant from the R.A.F. Sports Board. In addition, the association possesses 10 national dinghies, 10 *Yachting World* dinghies, and a number of ex-German dinghies, making a total fleet of 108 craft.

REST-CENTRE: Some aspects of the R.A.F. Rehabilitation Centre at Headley Court, near Leatherhead, which is primarily devoted to speeding recovery of injured aircrew. The exterior view (top left) shows the exercise hall; the attractively furnished sergeants' mess dining room is shown at top right. Equally pleasant surroundings are found in the N.A.A.F.I. lounge (right). The Centre, which was formally opened by the Duchess of Kent on July 3rd last year, stands in 80 acres. Further details are given below.

G/C. N. C. Walker has been appointed Rear Commodore of the dinghies section, and W/C. F. C. Griffiths is Rear Commodore of the new cruising section. This may form with two cruising boats loaned by B.A.F.O. and will have the use of the cruising yacht *Pirrol*, lent by H.Q., Coastal Command. Warrant Officer G. S. Lang and F/L. R. H. Williams will head the committee to supervise the conversion of airborne lifeboats.

The Commodore of the Association is A/Cdre. A. W. B. McDonald and the Vice-Commodore S/L. W. H. Cauley.

R.A.F. Rehabilitation

HEADLEY COURT, the R.A.F. Rehabilitation Centre, some views of which are seen in the photographs above, was presented to the Air Ministry by the Chartered Auctioneers' and Estate Agents' Institute from their R.A.F. Pilots' and Crews' Fund, which raised over £384,000. The property, consisting of a Jacobean-style manor house in 80 acres of grounds, was accompanied by a further gift by the Institute of £150,000 towards the cost of building a sergeants' mess and airmen's quarters for patients and staff, an administration unit and a remedial block.

The original building is used as an officers' mess and the new quarters have been designed to harmonize with the country-house atmosphere which, it was felt, would give best results in rehabilitating airmen. The design of these buildings, executed by Arthur W. Kenyon, C.B.E., F.R.I.B.A., M.T.P.I., is, incidentally, the subject of an illustrated article in the January 12th issue of our associated journal *The Architect and Building News*.

During actual remedial periods at the Centre, all patients are treated alike and no rank is observed, but domestic conditions vary and mess traditions are maintained.

R.N.V.R. Opportunity

THE Admiralty are inviting former Naval pilots and any now serving in the R.N.V.R. who have completed 300 hours' flying in service aircraft to re-enter on a short service commission. These commissions will normally be for four years but may extend to six years in some cases. They carry the new improved rates of pay and flying pay and a gratuity will be paid at the end of the commission, e.g., £700 after four years. The maximum age on entry is 33 years. Applications, preferably accompanied by Flying Log Books, should be addressed to the Secretary of the Admiralty (C.W. 522), London, S.W.1.

Reunion

R.F.C. (Boys) Halton, 1917/1918.—Those interested in second reunion should communicate with J. E. Browning, 25, Grove Avenue, London, N.10.

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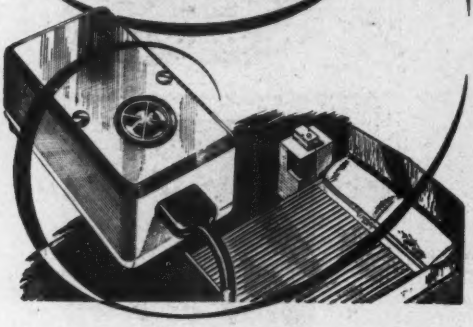

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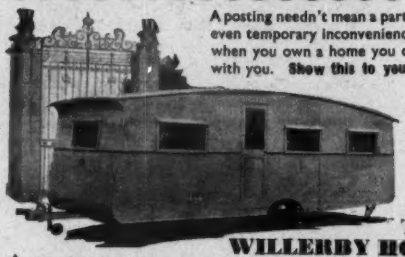

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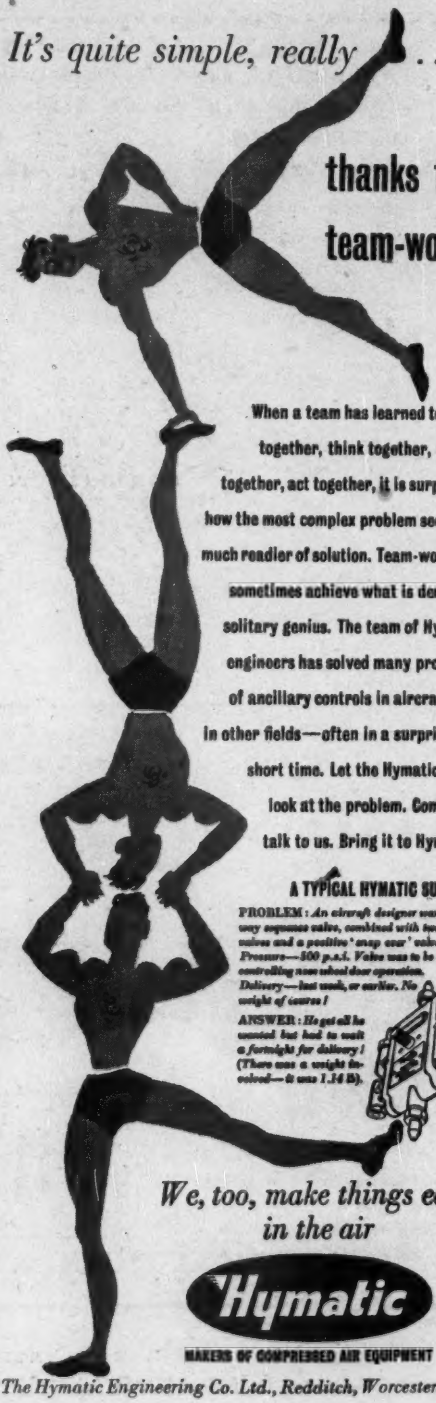

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APPLICATIONS in writing with full details of qualifications, past experience, etc., and stating whether overseas post is desired should be addressed to:

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THESE should all be clearly marked on the outside "AIRCREW Application/P." [5737

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GLOSTER AIRCRAFT Co., Ltd., have vacancies for senior jig and tool draughtsmen; write giving full details of previous experience, age and salary required. to—Employment Officer, G.A.C., Ltd., Hucclecote, Glos. [5729

STRESSMEN, preferably with at least five years' experience on aircraft structures, required for very interesting and varied programme of work.—Apply Portsmouth Aviation Developments, Ltd., The Airport, Portsmouth. [5775

COST clerk required with detailed aircraft costing experience; knowledge of punch card system an advantage; pension scheme.—Applications in writing to Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middx. [5790

SITUATIONS VACANT

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AERODYNAMICISTS with first-class honours degree in mathematics or engineering, preferably with several years' practical experience, though not essential.

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GROUND engineer required immediately, licenced in categories A and C, to service Auster and Miles Messenger with Cirrus engines; apply in writing, enclosing copies of references and stating salary required to—Shannon Aero Club, Coonagh Airfield, Limerick, Eire. [5763

AERODYNAMICIST (male) required, degree in mathematics or engineering and several years' practical experience in aerodynamics section essential.—Applications in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds. [0592

THE de Havilland Aircraft Co., Ltd., have vacancies for a technical author and technical illustrators; previous aircraft experience essential.—Apply in writing, stating age, experience and salary required, to Chief Draughtsman, The de Havilland Aircraft Co., Ltd., Hatfield, Herts. [5720

PLANNING engineers, senior, required for planning of gas turbine repair projects; experience of gas turbine or reciprocating aircraft engine work essential; write, giving age, experience and salary required to—The Personnel Officer, The de Havilland Engine Co., Ltd., Stonegrove, Edgware, Middx. [5785

SENIOR Technical Assistant required for aero engine stress office; knowledge of reciprocating and gas turbine engines desirable, B.Sc. or equivalent preferred; write giving age and full details of previous experience and salary required to—The Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middx. [5753

ELECTRICAL field service representative required by aircraft manufacturers' service department in the south; applicants must possess extensive knowledge and outstanding practical experience of the servicing and repair of modern aircraft electrical systems; a current "A" licence and a flair for service work.—Box 7971. [5744

ASSISTANT chief inspector required by East London firm dealing with aircraft electrical equipment; thorough knowledge of A.I.D. procedure and mechanical and electrical inspection experience; national or higher national certificate in electrical engineering; state full details of experience with age and salary required.—Box 8090. [5770

APPLICATIONS are invited from senior and intermediate design draughtsmen, experience of aero-engine design desirable but not essential.—Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0449

WANTED, an electrical and electronics engineer with instructional experience and knowledge of aircraft instruments as lecturer-demonstrator to standards of aircraft engineers' A. and C. licences and serving technical officers.—Apply, giving full details of qualifications and experience, to the Commandant, A.S.T., Hamble, Hants. [0528

THE DE HAVILLAND AIRCRAFT Co., Ltd., have vacancies for senior design and intermediate draughtsmen (preferably with aircraft experience) in their Hatfield and London (Regent Street) offices.—Applications stating age, experience and salary required, to Chief Draughtsman, de Havilland Aircraft Co., Ltd., Hatfield, Herts. [5564

NORTHALAIR, Ltd., invite applications from first class senior production drawing office checkers for light mechanical and precision equipment for aircraft pressurising and air conditioning systems.—Written applications, stating age, qualifications, experience and salary required, to the Personnel Officer, Normalair, Ltd., Yeovil, Somerset. [5771

SENIOR aerodynamicists required for work on high performance aircraft; applicants should have an engineering degree and experience in design of controls, performance calculations and estimation of aerodynamic loads.—Write, giving particulars of age, experience and salary required, to Employment Manager, Vickers-Armstrongs, Ltd., Weybridge. [5663

TEST engineers required as from January 1st for development work on aircraft hydraulic systems; previous experience essential; age 21-35.—Apply in writing, stating age, experience and salary required, or by telephone, to Mr. R. T. Sewell, Chief Test Engineer, British Messier, Ltd., Cheltenham Rd. East, Gloucester Tel. Churchdown 3281 [5696

(Continued on next page)

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SITUATIONS VACANT

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AIRCRAFT Draughtsmen are required by the English Electric Co., Ltd., to meet an expanding programme at their Warton and London design offices; draughtsmen of all grades with appropriate aircraft experience are invited to apply for these vacancies; write quoting ref. 120D, to—Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5780

HANDLEY PAGE (READING), Ltd., have vacancies in their design office for stressmen who should have at least two years' experience and with qualifications up to A.F.R., A.e.S. or B.Sc. standard, these vacancies carry excellent prospects for the right men.—Send full particulars to the Personnel Officer, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading. [0574

HANDLEY PAGE, Ltd., have vacancies for senior design and intermediate draughtsmen, preferably with aircraft experience for their Cricklewood and Radlett offices; consideration will be given to applicants with experience in light structural or mechanical engineering, possession of O.N.C. or H.N.D. (Mech. or Elect.) an advantage; loftsmen with previous experience of full scale layout work or similar workshop practice; these vacancies are at the Cricklewood office only.—Applications, stating age, qualifications and details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [5684

AIRCRAFT loftsmen (senior) required, sound experience in similar capacity essential.—Applications in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [0585

APPLICATIONS are invited from design draughtsmen and stressmen also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.

APPLICATIONS should state full particulars of experience and qualifications and should be addressed to The Personnel Manager, The de Havilland Engine Co., Ltd., Stonegrave, Edgware, Middx. [0575

SENIOR aerodynamicists required for work on high-performance aircraft; applicants should have an engineering degree and experience in design of controls, performance calculations and estimation of aerodynamic loads.—Write, giving particulars of age, experience and salary required, to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0566

STRESS or mechanical test engineers are required for the Aircraft Division of the English Electric Co., Ltd., at Warton Aerodrome, near Blackpool; these are interesting vacancies on new projects offering good prospects to suitably qualified engineers experienced in either of these fields.—Write giving full details and quoting ref. 434B to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5736

AERODYNAMICISTS with an engineering degree and good mathematical background are required for the Aircraft Division of the English Electric Co., Ltd., at Warton Aerodrome, near Blackpool; previous experience is desirable but suitably qualified engineers without previous experience in aerodynamics who desire to enter this field will be given necessary training.—Write giving full details and mentioning ref. 435E to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [5735

WANTED, navigation instructor for reserve flying school.—Apply Secretary, Universal Flying Services, Ltd., Fair Oaks Aerodrome, Chobham, Woking, Surrey. [5767

SENIOR Aircraft Estimators required; write, stating experience and qualifications to—Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [5779

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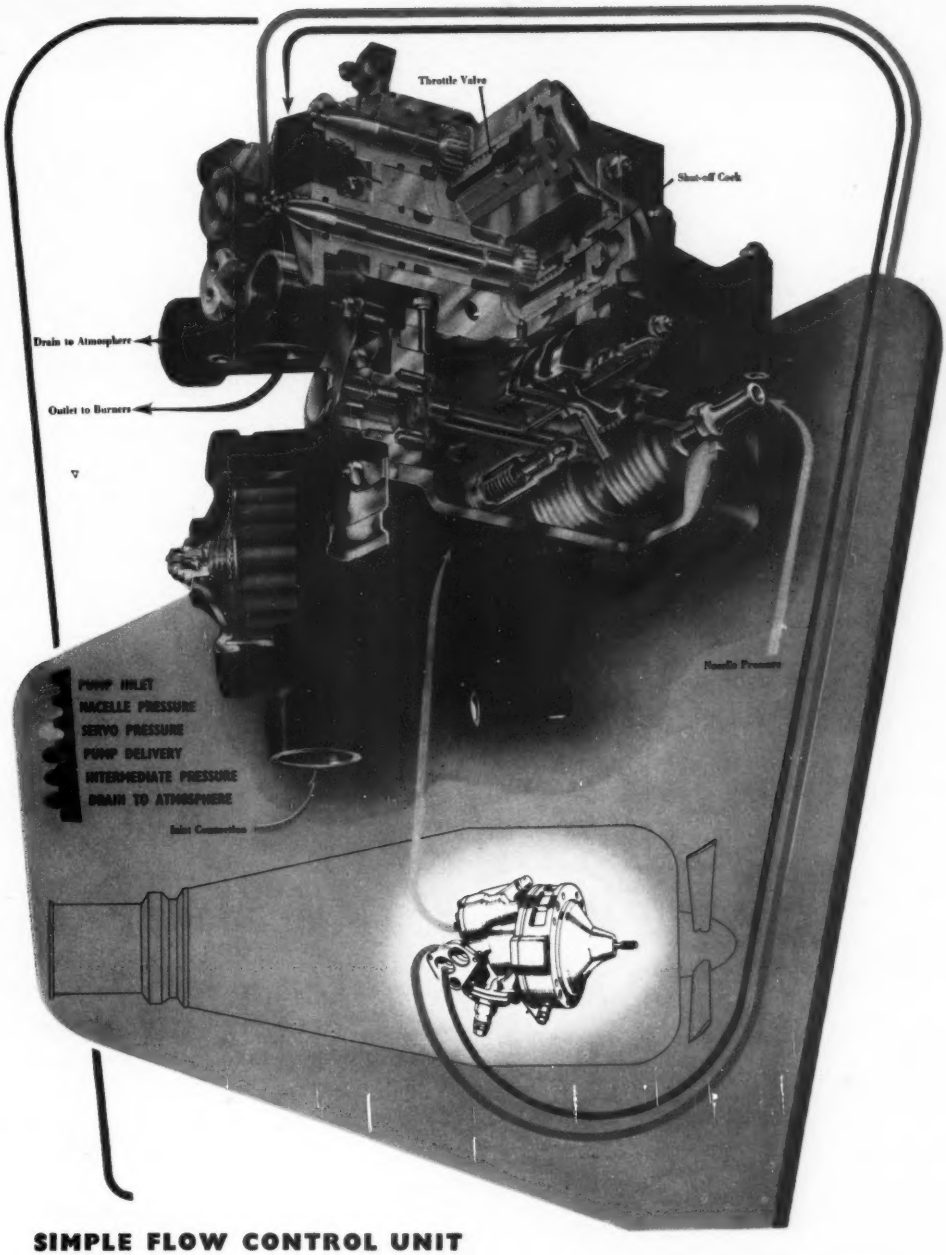

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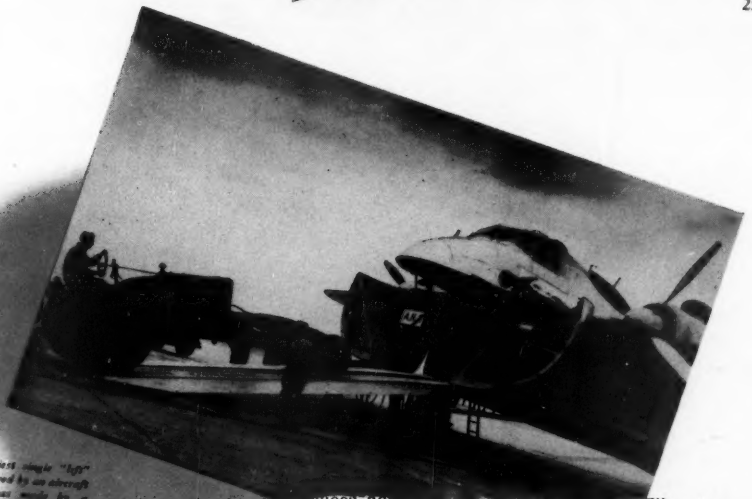

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